

Chemical Engineering

WITH CHEMICAL & METALLURGICAL ENGINEERING

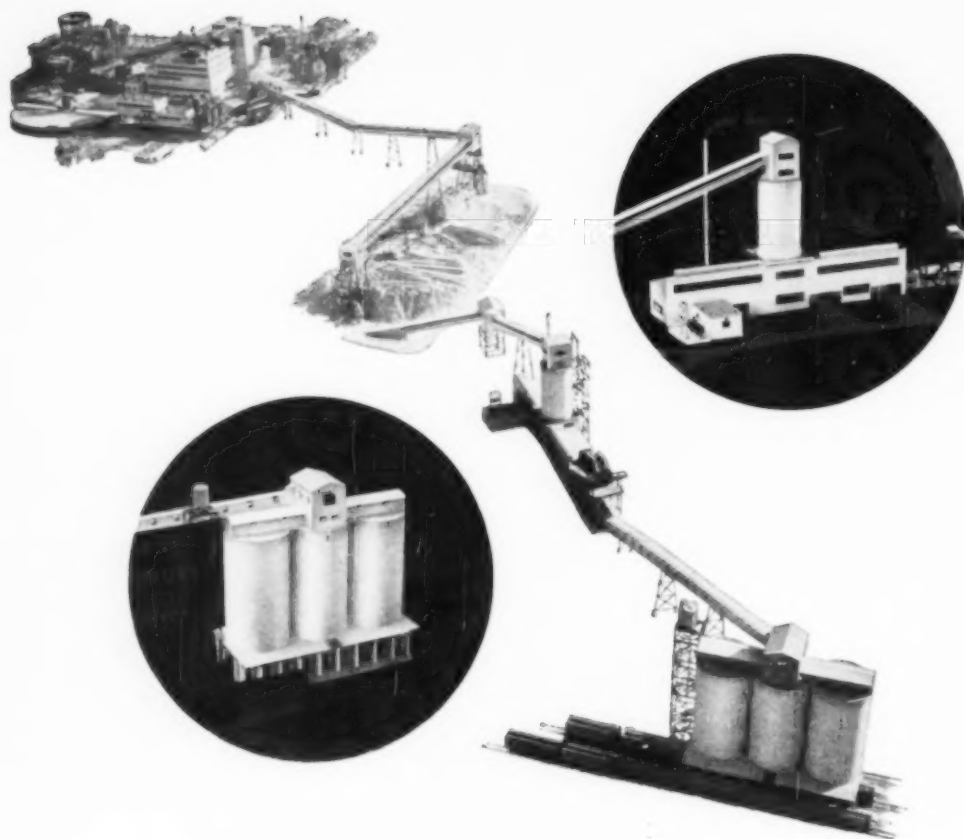
JUNE 1949



STEEL TANKS IN CORN PRODUCT'S NEW WET MILLING PLANT. IN ARCHITECTURE AND PROCESS, A PLANT OF DISTINCTION

A McGraw-Hill Publication

Fifty Cents



New Drying and Storage Plant at Noralyn Phosphate Mine

Larger tonnages of high grade phosphate than ever before are now available from International's Florida mines as a result of the completion of new drying and storage facilities at the new Noralyn Mine.

Phosphate from the Noralyn Washer and Flotation Plant is carried by overhead belt conveyors and distributed by grades on wet storage. From an underground tunnel, selected material is conveyed to the drying plant shown in the photo at upper right where it is dried to standard specifications. It is then conveyed to the storage silos shown in the lower left photo where it is loaded automatically into rail cars.

The modern new drying and storage plant at Noralyn Mine will increase production capacity, speed deliveries, and improve service to buyers of International's Florida Phosphate for agricultural and industrial markets, domestic and foreign.



Tennessee Phosphate ALL COMMERCIAL GRADES Florida Pebble Phosphate

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

GENERAL OFFICES: 20 NORTH WACKER DRIVE, CHICAGO 6

JUNE 1949

Chemical Engineering

WITH CHEMICAL & METALLURGICAL ENGINEERING

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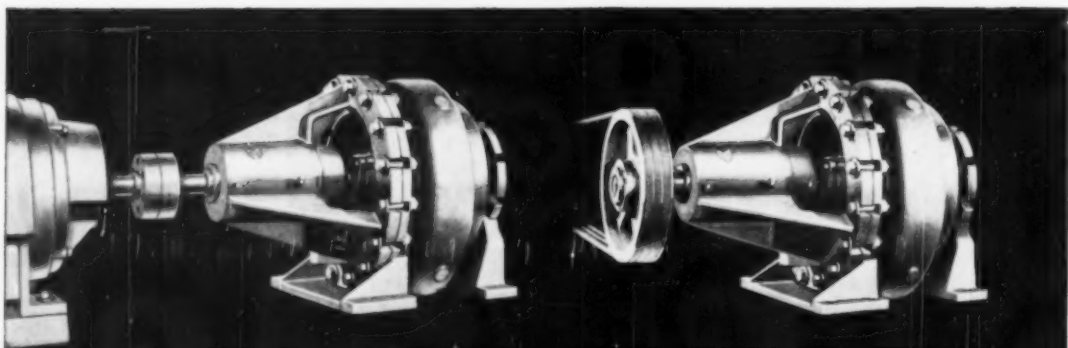
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Solve Fluid Flow

WITH THESE ALLIS-



These Solids Pumps Look Alike, but...



THE "PW" IS FOR CORROSIVE FLUIDS

Working parts of direct-driven PW solids pump are made of special alloys designed for maximum resistance to corrosion. These Allis-Chalmers pumps handle a wide range of chemical pulps and liquids with negligible dilution from sealing water.

- ▶ Has special corrosion-resistant alloy parts.
- ▶ Designed for direct-drive, motor or engine.
- ▶ Handles up to 40% solids in suspension.
- ▶ Only 5 major parts — high accessibility.
- ▶ 175 to 8,000 gpm; heads to 140 ft.

Send for Bulletin 08B7112.



THE "CW" IS FOR ABRASIVE FLUIDS

Working parts of CW solids pump are made of *Allisite* alloy, an extremely hard, non-machinable alloy that offers remarkable resistance to abrasion. Effective in handling slurries, tailings, sludges. Delivers near-rated capacity until parts are completely worn out.

- ▶ Has hard *Allisite* alloy working parts.
- ▶ Driven through Texrope V-belt drive and motor.
- ▶ Also handles up to 40% solids.
- ▶ Parts accessible without disturbing piping.
- ▶ 175 to 8,000 gpm; heads to 140 ft.

Send for Bulletin 08B6381B.

PROFITABLE SOLUTIONS to your fluid handling problems depend on getting the *right* pumps specified for your job in the first place. Then your pumps will deliver rated capacity month after month . . . and you'll have better control of your fluid flow operations.

Insist on getting top value in terms of durability when buying pumps. The centrifugal pumps shown here are excellent examples of sound pump

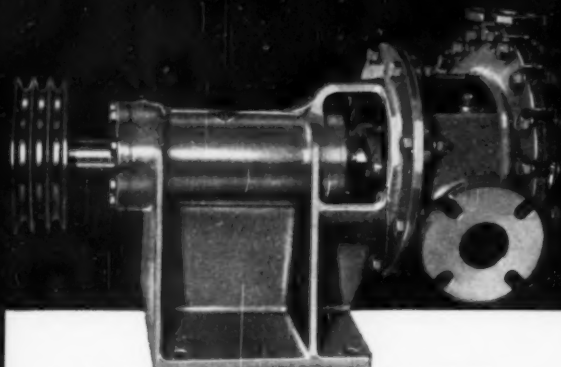
design . . . with strength features that "pay off" in long, reliable service.

Another important thing — get pumps that are easy to install and maintain. Here too, you'll find Allis-Chalmers offers pumps designed for ease of packing . . . ease of disassembly . . . ease of replacing standard parts.

Find out more about this modern pump line from the A-C representative in your area.

Problems

CHALMERS PUMPS



PROCESS PUMP FOR ABRASIVES, CORROSIVES, ACIDS OR ALKALIS

This Allis-Chalmers process pump is winning acceptance for a wide variety of chemical processing applications. Operators report big savings in replacement parts costs! Obtainable with a variety of special alloy working parts, it can be used for corrosive, abrasive, acidulous or alkaline liquors.

- ▶ Available with choice of alloy parts.
- ▶ Stuffing box is on suction side of pump; pressure on packing can't exceed suction head.
- ▶ Rotating element can be adjusted axially to maintain pumping capacity and head.
- ▶ 15 to 1,300 gpm; heads to 275 ft.

Send for Bulletin 08B6615A.

Teslap, Pedrifugal, Allisite are Allis-Chalmers trademarks.

A-2723

ALLIS-CHALMERS, 1147A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

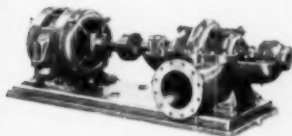
One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products

CHEMICAL ENGINEERING—June 1949

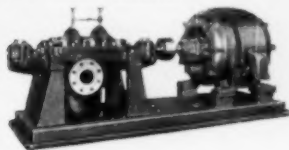
OTHER ALLIS-CHALMERS CENTRIFUGAL PUMPS FOR THE CHEMICAL INDUSTRY



SINGLE SUCTION base mounted and close-coupled type pumps. Either type available of special alloy construction for corrosive liquids. Bulletins 52B6351A and 52B6140A.



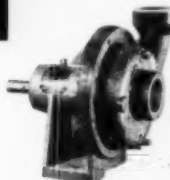
SINGLE STAGE double suction, split casing pumps. Can be constructed of many special machinable alloys. 30 to 170,000 gpm; heads to 475 ft. Bulletin 08B6146.



MULTI-STAGE pumps for high pressure systems. Constructed of materials to suit application in 2 to 7 stages for capacities up to 10,000 gpm and heads to 2,000 ft.



SELF-PRIMING pump has rapid, automatic priming action. Full capacity after 3 minutes operation on a 20 ft suction line. Sizes to 350 gpm; heads to 300 ft. Bulletin 08B619B.



PEDRIFUGAL
Economy pump for average requirements up to 500 gpm; 100 ft heads.



Answers
MOST
corrosion
problems

1885

CROLOY

TYPE 304

The most popular grade of stainless steel tubing. Ask for Bulletin TDC-130 describing its physical, mechanical and fabricating properties.

welded or seamless
STAINLESS STEEL TUBING



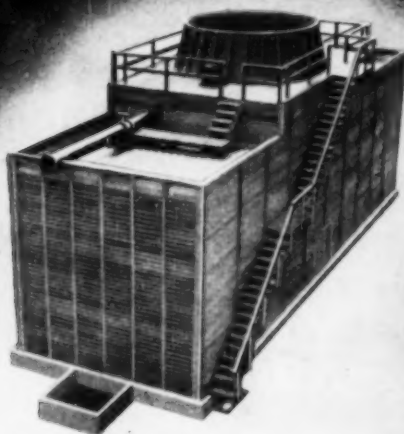
THE BABCOCK & WILCOX TUBE COMPANY
General Offices: Beaver Falls, Pa.
Plants: Beaver Falls, Pa. and Alliance, Ohio



A full range of Stainless, Alloy and Carbon Steel Tubing for All Pressure and Mechanical Applications.

TA 14685

Specify MARLEY Double-Flow



FOR SAFE OPERATION AND MAINTENANCE

STAIRWAY . . . DOUBLE-FLOW towers are equipped with a stairway built at the enclosed endwall of the tower. This eliminates fog envelopment and ice formation on stairways or ladders built over louvered sections. Operators do not have to climb high, dangerous ladders.

HANDRAILS . . . stairway and wide, level fan deck are guarded with high handrails. At no time is the operator at the mercy of high, gusty winds or in danger of inadvertently falling off the tower.

OUTSIDE WALKWAY . . . a short stairway leads to a walkway over each distribution basin. Water level may easily be adjusted or the basin cleaned. Complete flexibility of operation or maintenance is a result without the usual risks and dangers involved.

INSIDE WALKWAYS . . . through the interior of the tower, walkways enable the

operator to observe water breakup, condition of structure, and operating conditions of the tower. This can all be checked while the tower is in operation without danger to the operator.

WALLED FAN CYLINDERS . . . each fan is enclosed with a fan cylinder . . . high enough for safety, low enough for easy inspection. And, there is plenty of room between the cylinder and fan deck railing for free movement without risk.

Tower owners and operators know that MARLEY DOUBLE-FLOW towers are **SAFE TOWERS . . .** safe in any stage of operation or maintenance . . . safe in any weather.

That's why more and more Safety Engineers of America's great industries are recommending **MARLEY DOUBLE-FLOW COOLING TOWERS.**

Ask for a MARLEY Factory-Trained APPLICATION ENGINEER to tell you more about the MARLEY DOUBLE FLOW Cooling Tower and its numerous SAFETY FEATURES. He'll be glad to help you solve YOUR water cooling problems. No cost or obligation.



THE MARLEY COMPANY, INC. • KANSAS CITY 15, KANSAS

**THESE ARE THE TROUBLEMAKERS
YOU WISH TO STOP**



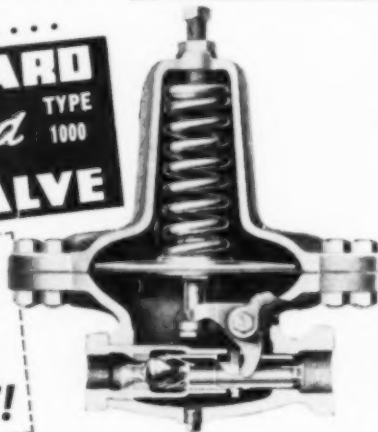
**HERE IS THE VALVE THAT
WILL STOP THEM**

CASH STANDARD
Streamlined
PRESSURE
REDUCING VALVE
TYPE 1000

**THIS IS THE BULLETIN (No. 962)
THAT TELLS YOU WHY**



**SEND
FOR IT!**



**THESE ARE THE BENEFITS YOU GET
BECAUSE OF ITS ASPIRATOR AND
STREAMLINED FLOW**

Maximum Capacity When Needed Most • Accurate Pressure Control Under Toughest Working Conditions • Trouble-Free Service • Smooth Operation • Tight Closure • Accurate Regulation • Speedier Production Results • Elimination of Failures • Constant Delivery Pressure • Cost Saving Operation • No Spoilage • Practically Zero in Maintenance Costs.

**CASH STANDARD
CONTROLS..
VALVES**

**A. W. CASH COMPANY
DECATUR, ILLINOIS**

and here is proof from a user

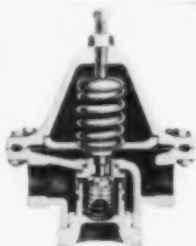
"We are more than satisfied with our STREAMLINED Valve performance. They are all over this plant and, frankly, I have forgotten about most of them as I never have any trouble.

"What I like about these valves is that in some cases our initial pressures vary considerably, yet the reduced pressure is held steady. This work is all processing and is very important.

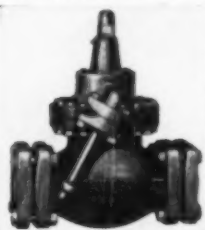
"Your competitors will have a hard time convincing me there is a better valve to be had."

**BULLETINS
AVAILABLE
ON OTHER
CASH STANDARD
VALVES**

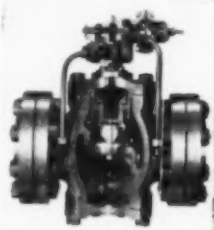
Send for them



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve—designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



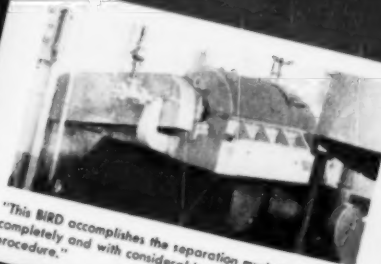
Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air, with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

It's what these BIRDS are doing that counts

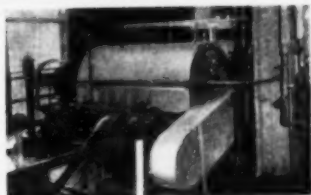
Here's what users say:



"These BIRDS are doing a separating job in 20 seconds that used to take 12 to 24 hours. Recovery is now close to 100%. Quality and uniformity of product are vastly improved."



"This BIRD accomplishes the separation much faster, more completely and with considerably less labor than the old procedure."



"The BIRD dewateres our crystals in a relatively dilute slurry continuously and without appreciable drop in temperature. No other equipment could meet our requirements."



"Our BIRDS are a key factor in effecting a continuous process. Their efficiency is remarkable. The overall yield of the process is over 99 per cent."



"This BIRD is the most trouble-free unit in our entire process. It's just like part of a pipe line as far as supervision is concerned."

Maybe BIRDS can do as much for you



To help you find out without any commitment on your part the Bird Research and Development Center is at your command.

BIRD MACHINE COMPANY
South Walpole, Massachusetts

THE BIRD

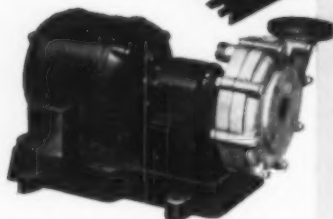
CONTINUOUS CENTRIFUGAL FILTER

ACE

HARD RUBBER and PLASTICS

STOP CORROSION AT ALL VITAL SPOTS

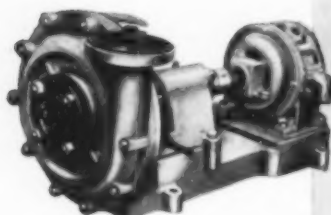
For instance ... ACE PUMPS for Every Need!



Hard Rubber Centrifugal Pump Type WAM, Motor Driven. Up to 80 gpm. capacity.

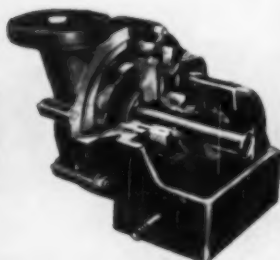


Hard Rubber Centrifugal Pump Type WAM, Motor Driven, Extended Base. Up to 80 gpm.

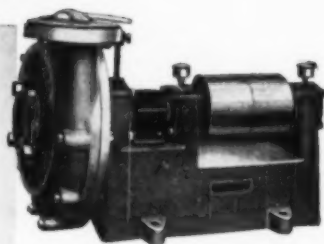


Hard Rubber Lined Centrifugal Pump Type WEFM, Motor Driven. Capacity to 350 gpm.

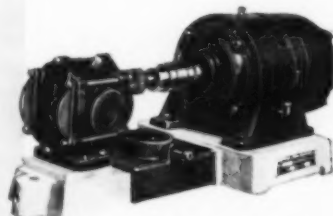
Ace hard rubber resists all alkalis, metallic salts of inorganic acids, hydrochloric acid any strength, nitric acid up to 16° Baume, phosphoric acid to 75%, sulphuric acid up to 50° Baume, most other inorganic acids any strength, and countless other corrosive solutions and fumes. Other Ace plastics such as Saran and Parian (polyethylene) extend this range of applications still further. Catalog 300-7 and Ace plastics bulletins tell you where Ace-clad and Ace molded equipment saves for you—send for them today.



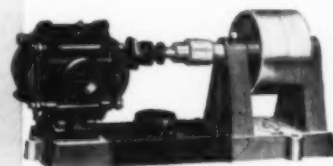
Cutaway view of Ace pump shows complete protection with Ace acid-resisting rubber.



Hard Rubber Lined Centrifugal Pump Type WEFB, Bolt Driven.



Ace Hard Rubber Rotary Gear Pump, Motor Driven. Capacity 7 gpm.



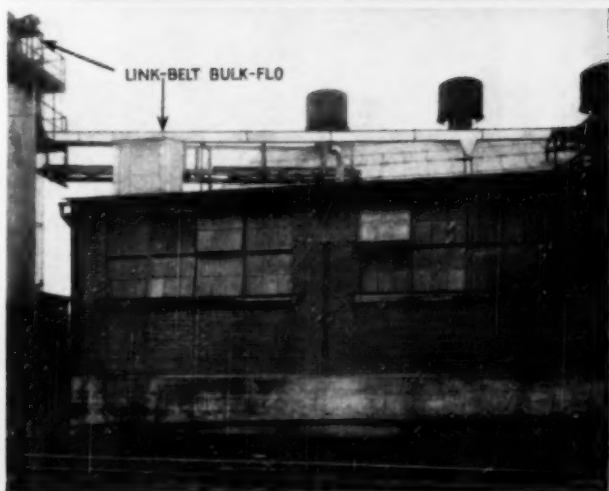
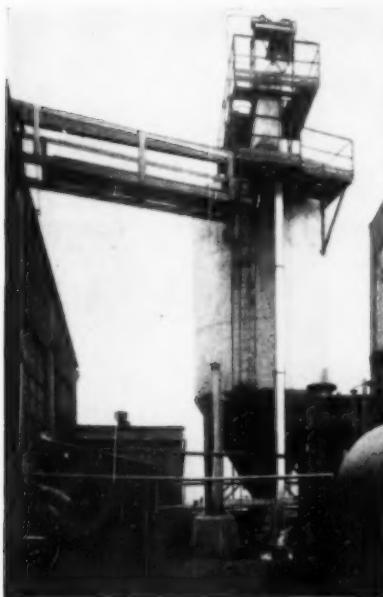
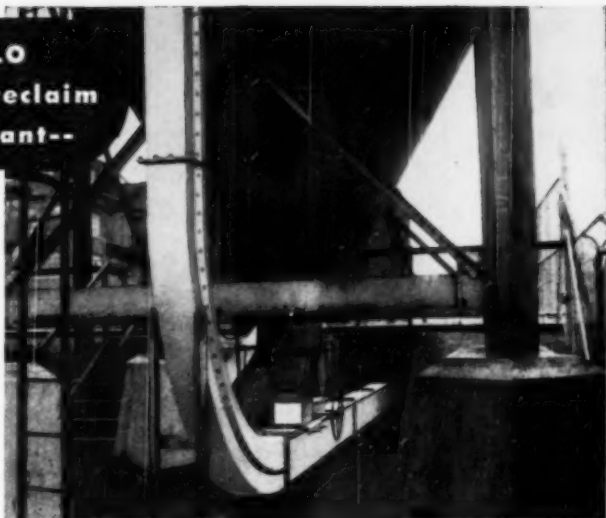
Ace Hard Rubber Rotary Gear Pump, Belt Driven. Capacity 7 gpm.



AMERICAN HARD RUBBER COMPANY • 11 MERCER STREET • NEW YORK 13, N. Y.

How LINK-BELT BULK-FLO Conveyors unload and reclaim soda ash at chemical plant--

One Bulk Flo, following L-path of 40 ft. horizontal by 50 ft. vertical, receives soda ash through canvas chute from bottom of R. R. car, carries it along horizontal run and then vertically into storage bin. This Bulk-Flo delivers either into a short horizontal screw conveyor feeding into center of bin, or to Bulk Flo conveyor No. 2, which extends from top of bin and diagonally across roof of process building a distance of about 75 feet. It discharges the soda ash through building roof to either of two collecting hoppers.



How LINK-BELT
BULK-FLO Conveyors
can serve you . . .

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40,
Atlanta, Dallas 1, Houston 3, Minneapolis 5,
San Francisco 24, Los Angeles 33, Seattle 4,
Toronto 8. Offices in Principal Cities.

The BULK-FLO Conveyor provides an economical means for handling free-flowing, granular, crushed, ground or pulverized materials. It is a feeder, conveyor and elevator all in one compact automatic unit. It minimizes breakage, degradation, dusting and contamination.

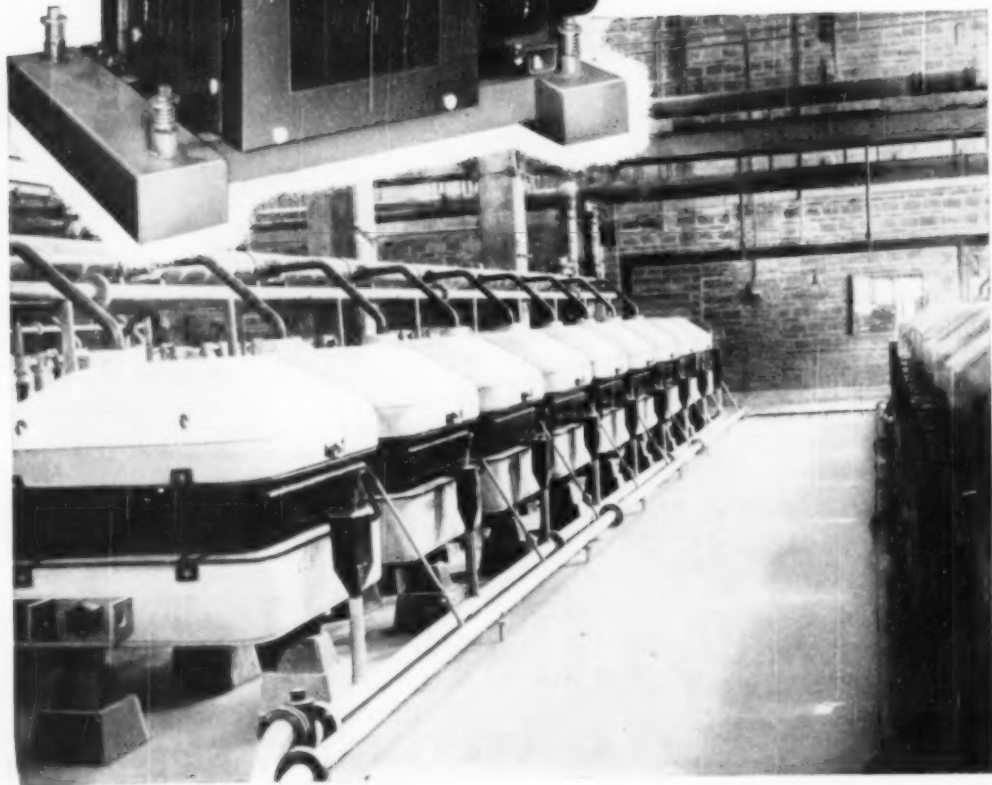
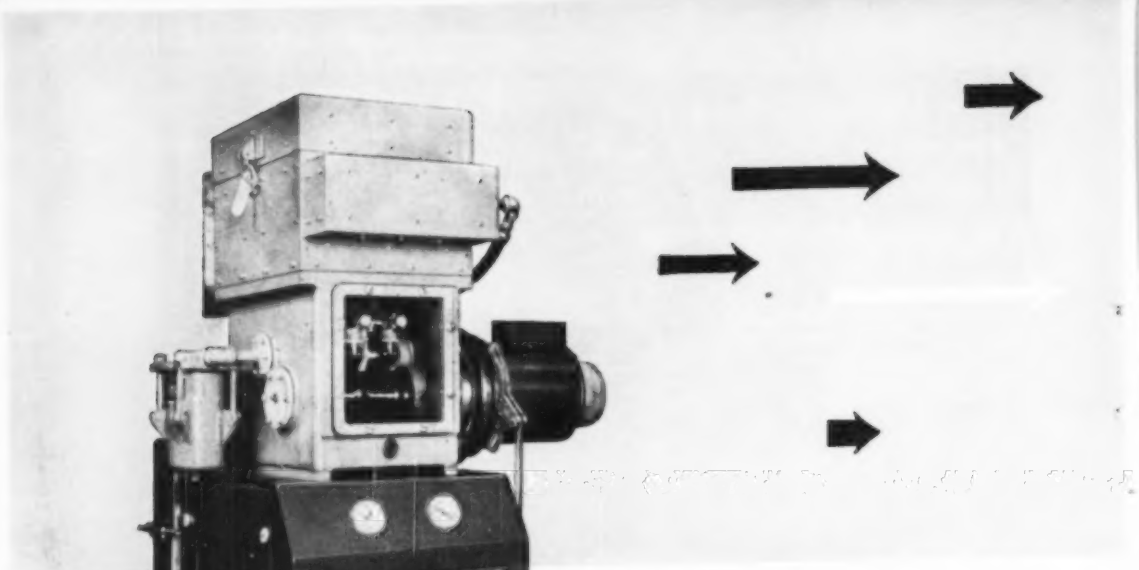
Book No. 2175, describing many applications of this flexible unit, will be sent upon request.

A Link-Belt Engineer will be pleased to discuss your problems without obligation.

LINK-BELT
CONVEYING MACHINERY



11,408



Now you can design your Cell Rooms the way you want them!

Here's why... I-T-E now makes available a
NEW LOW VOLTAGE MECHANICAL RECTIFIER
for applications up to 10,000 Amperes, at 50 to 400 Volts D-C

with these significant advantages:

- 1. Higher operating efficiency**—actually 92% to 96.5% in the 50 to 400 volt range! You don't have to resort to high voltage to obtain high efficiency, if you use the I-T-E Mechanical Rectifier.
- 2. Reduced Size.** A typical plant layout will show space savings of up to 50%. Consider what this means to you in decreased building costs.
- 3. Simplified Maintenance.** No complicated tools or instruments are needed for the adjustment and maintenance of the new I-T-E Mechanical Rectifier.
- 4. Low over-all cost:** Unit assembly at factory reduces installation cost. NO CRANE SERVICE is required in Rectifier Building.

FIRST SUCH UNIT IN AMERICA NOW INSTALLED AND OPERATING!

● The Mechanical Rectifier made its debut and became a reality in this country on February 8th, 1949, when a unit rated 3500 amperes was placed in service in the plant of the Buffalo Electro-Chemical Company, Buffalo, N. Y., carrying 5000 amperes at 260 volts d-c with an efficiency of 96%.



MECHANICAL RECTIFIERS

I-T-E CIRCUIT BREAKER COMPANY, 10TH AND HAMILTON STREETS, PHILADELPHIA 30, PENNSYLVANIA
31 OFFICES IN THE UNITED STATES • In Canada, EASTERN POWER DEVICES LTD., TORONTO

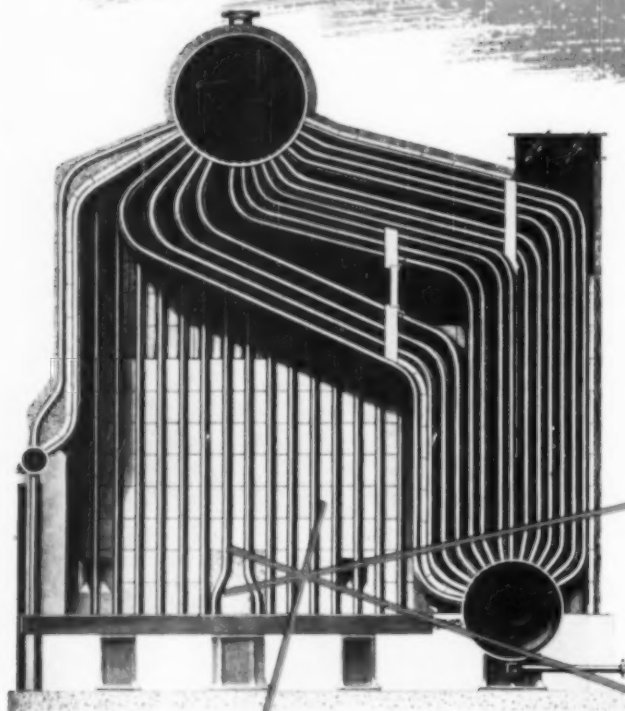
SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES
CIRCUIT BREAKERS • MECHANICAL RECTIFIERS • RESISTORS • SPECIAL PRODUCTS

Get the complete story!



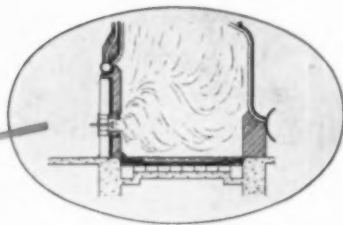
I-T-E Bulletin 4809 contains complete technical information on the I-T-E Mechanical Rectifier, as well as a detailed presentation of its operating principles. Send for it today!

THE C-E PACKAGE BOILER

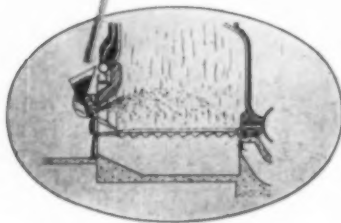


Furnished in capacities of
10,000 to 50,000

lb of steam per hr, the Package Boiler is designed for four methods of firing — spreader stoker, single-retort underfeed stoker, oil or gas burners. Any of these methods may be substituted for any other should a change in the fuel market make a change in firing equipment desirable.



OIL OR GAS BURNERS — The Package Boiler is ideally suited to the use of either oil or gas. Designed for front wall firing, the furnace is properly proportioned for the normal flame characteristics of the burners and provides ample volume for completion of combustion before the gases enter the boiler.



C-E SPREADER STOKER — Installations of C-E Spreader Stokers throughout the United States and in many foreign countries have demonstrated the ability of this stoker to burn every kind and grade of bituminous coal, as well as sub-bituminous coals and lignite. It has been notably successful in burning the lower-priced poorer grades of coal which are so difficult to burn satisfactorily on other types of stokers.

COMBUSTION ENGINEERING

A MERGER OF COMBUSTION ENGINEERING COMPANY, INC. AND THE SUPERHEATER COMPANY

.....Choice of industry after industry

Why

has the Package Boiler been selected by such widely varying industries as those listed?

BALANCED DESIGN

BECAUSE it has not one or two features for special needs, but a *completely balanced design* that adapts itself to many conditions . . . a design in which each element is coordinated with every other for top performance.

EFFICIENT PERFORMANCE

BECAUSE the C-E Package Boiler has high efficiency over a wide range of output and responds to rapid load swings . . . characteristics especially advantageous in many industrial plants.

EASY OPERATION

BECAUSE the C-E Package Boiler is simple to operate and maintain at peak efficiency — a boon to plants having limited personnel.

CHOICE OF FUELS AND FIRING

BECAUSE in addition to its wide adaptability, the C-E Package Boiler permits you to choose the one *best* method of firing for the fuel and load conditions of your plant.

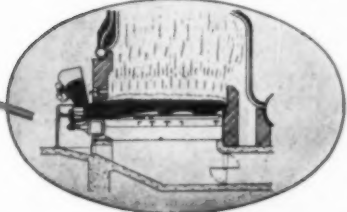
LOWER COST

BECAUSE the standardized balanced design of the C-E Package Boiler effects economies in engineering, fabrication, and erection which are passed on to you in lower first cost.

UNIFIED RESPONSIBILITY

BECAUSE the C-E Package Boiler is a complete unit . . . boiler, furnace setting, fuel-burning equipment, controls, forced draft . . . giving you the added benefit of *one contract, one guarantee and one responsibility.*

Small wonder so many diverse industries select the C-E Package Boiler. If your requirements fall within the available capacity range, let C-E engineers match your needs to Package Boiler performance.



TYPE E UNDERFEED STOKER — Designed to burn both caking and non-caking bituminous coals, the Type E Stoker is one of the oldest and best-known stokers in America. Sound design, rugged construction and fine performance have made the Type E Stoker the recognized leader in its field.

PARTIAL LIST OF INDUSTRIES THAT HAVE SELECTED THE C-E PACKAGE BOILER

AUTOMOBILE
BAKERY
CHEMICAL
COLD STORAGE
DAIRY
GLASS
HOSIERY
HOSPITAL
INSTITUTIONS
LEATHER
LINOLEUM
MACHINERY
METALS
OIL
PACKING
PAINTS
PAPER
RAILROADS
RUBBER
STEEL
SUGAR
TEXTILE
TOBACCO
UTILITY

— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.



When Swenson Process Engineering

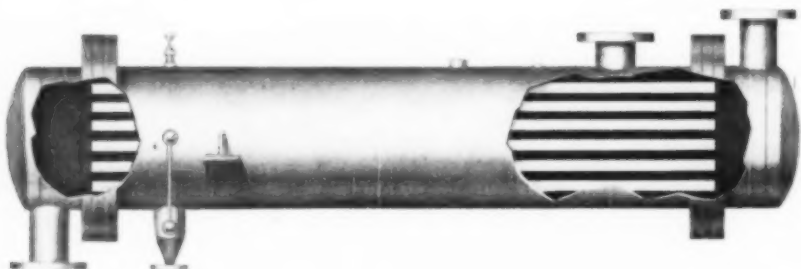
calls for Carbon-Tube

Where acids or acid solutions are to be heated with steam, or where heat must be transferred from liquid to liquid and either or both liquids are corrosive, Swenson Process Engineering frequently recommends the use of Swenson Heat Exchangers with carbon tubes.

These Heat Exchangers have proved eminently successful in a great many applications because of their resistance to corrosion, low friction-

al resistance, high coefficient of heat transfer, and relatively low original and operating cost. They may be arranged for single or multi-pass operation, as desired.

The tube sheet is usually fabricated of lead, lead-covered steel, rubber-covered steel or corrosion-resistant alloy — as conditions may require. If the liquid in the shell is corrosive, the shell also may be constructed of these materials.



SWENSON EVAPORATOR COMPANY

Division of Whiting Corporation

15669 Lathrop Avenue

Harvey, Illinois

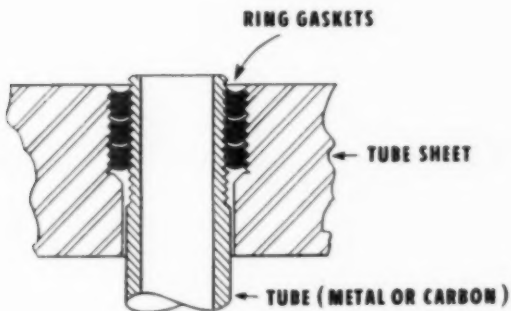
Eastern Sales Office and Export Department: 30 Church St., New York 7, N. Y.

In Canada: Whiting Corporation (Canada) Ltd., 47-49 Laplante Ave., Toronto 2

Heat Exchangers

The carbon tubes are not cemented to the tube (as is the case with most carbon-tube heaters), but are held in place by a patented Swenson tube anchorage consisting of a ring-gasketed joint (see illustration). This anchorage relieves the tubes of all stress caused by difference in expansion of the shell and the carbon tubes.

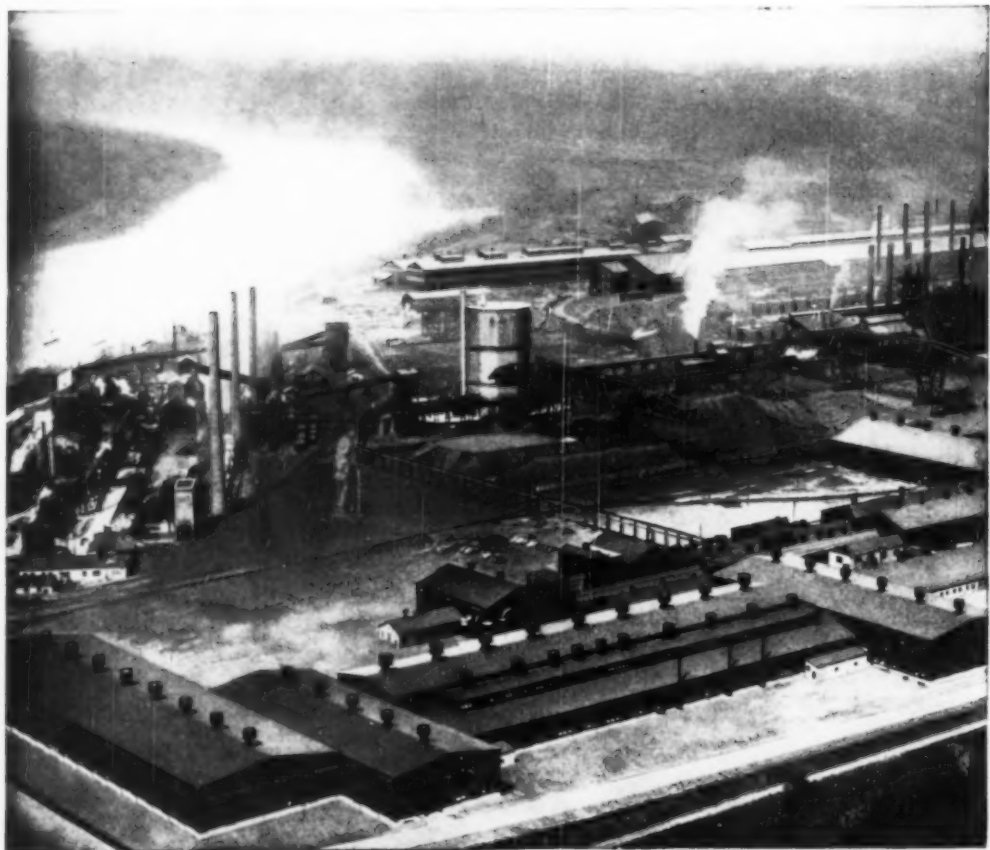
Similar construction has been used for several years in Swenson Evaporators for certain types of acid solutions. Let Swenson Process Engineering help you with problems involving heat transfer.



SWENSON

EVAPORATORS • FILTERS • CRYSTALLIZERS
SPRAY DRYERS

\$18,000,000 set of tools for the



CRUCIBLE

first name in special purpose steels

hot and cold rolled

STAINLESS SHEET AND STRIP

MASTER mechanic



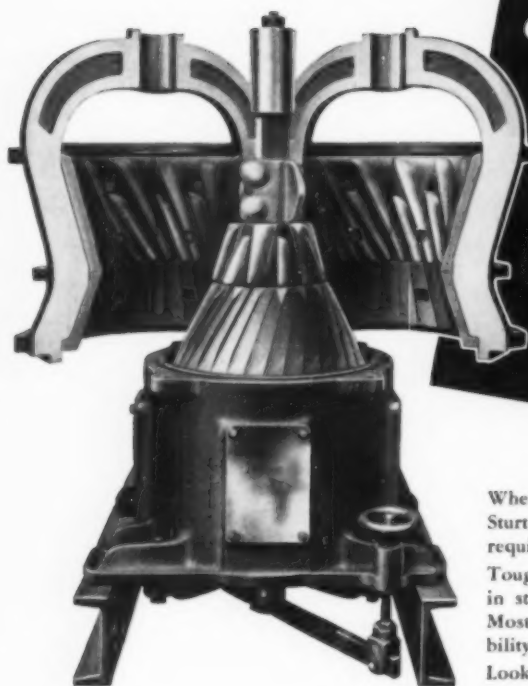
When a *master mechanic* gets new tools, expect master workmanship. And when CRUCIBLE, *master producer* of tool, alloy and specialty steels, designs an \$18,000,000 mill specifically for hot and cold rolled stainless sheet and strip, you can rightly expect the best that modern facilities and generations of *specialty product* leadership can provide.

For here, at CRUCIBLE'S new Midland Mill, is an entirely new concept in stainless sheet and strip production . . . here, for the first time, stainless sheet and strip are made as *specialty products*, by specialty production methods, in a mill built from the ground up for this purpose. Here at Midland are no mills designed for carbon steel production, re-powered for the heavier duty of rolling stainless, but \$18,000,000 worth of *brand new* equipment, designed and built for *modern* hot and cold rolling of stainless steel — in widths from $\frac{1}{2}$ " to 50" inclusive, and in all gauges, grades and finishes.

This is important news to every designer and fabricator of stainless steel products. For CRUCIBLE, pioneer in stainless steel since its inception, now offers a *completely integrated line*—sheet, strip, plates, bars, tubing, wire, forgings and castings.

In short, you can turn with every confidence to the *first name* in special purpose steels for *every* form of stainless. One of the largest and most highly specialized technical forces in the steel industry is at your service for specific application advice. And there are comprehensive data sheets available for all grades. Your inquiry will be welcomed.

CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, 405 Lexington Ave., New York 17, N. Y.
Branches, Warehouses, and Distributors in Principal Cities. Consult your Telephone Directory or Thomas' Register for Nearest Office.
HIGH SPEED • TOOL • STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEEL



When It's
Grinding or Pulverizing

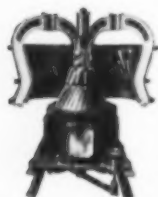
STURTEVANT
EQUIPMENT

*DOES THE
JOB FAST!*

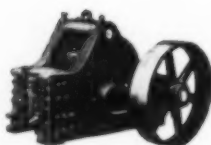
Whether you grind soft or hard materials, there is a Sturtevant Grinder or crusher exactly suited to your requirements.

Tough and rugged, Sturtevant Equipment has the built-in stamina to stand up under continuous operation. Most of this equipment has the "open door" accessibility which makes cleaning easy.

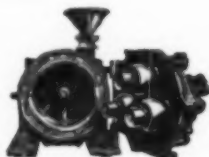
Look into Sturtevant Grinders and crushers for your applications. These machines will give you the exact mesh you want . . . cut your costs by increasing production. Write for catalog today.



ROTARY FINE CRUSHERS for intermediate and fine reduction (down to $\frac{1}{2}$ "). Open door accessibility. Soft or moderately hard materials. Efficient granulators. Excellent preliminary Crushers preceding Pulverizers.



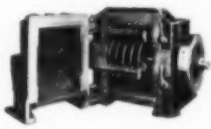
JAW CRUSHERS for coarse, intermediate and fine reduction of hard or soft substances. Heavy or light duty. Cam and Roller action. Special crushers for Ferro-alloys. Several types, many sizes.



RING-ROLL MILLS for medium and fine reduction (10 to 200 mesh), hard or soft materials. Very durable, small power. Operated in closed circuit with Screen or Air Separator. Open door accessibility. Many sizes. No scrapers, plows, pushers, or shields.



CRUSHING ROLLS for granulation, coarse or fine, hard or soft materials. Automatic adjustments. Crushing shocks balanced. For dry or wet reduction. Sizes 8 x 5 to 50 x 20. The standard for abrasives.



SWING-SLEDGE MILLS for coarse and medium reduction (down to 20 mesh). Open door accessibility. Soft, moderately hard, tough or fibrous substances. Built in several types and many sizes.



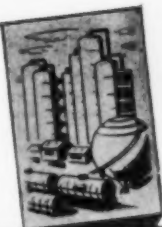
MOTO-VIBRO SCREENS screen anything screenable. Classified vibrations. Unit construction—any capacity. Open door accessibility. Open and closed models with or without feeders. Many types and sizes—range of work $\frac{1}{2}$ " to 60 mesh.

STURTEVANT MILL COMPANY

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DESIGNERS & MANUFACTURERS OF DENS AND EXCAVATORS • MIXERS • SCREENS • PULVERIZERS • ELEVATORS • AND COMPLETE FERTILIZER UNITS

it's **VALVOLINE**
at the refinery



it's **VALVOLINE**
when it's delivered



because every drum
is protected by
Tri-Sure Closures

SINCE 1866, the products of the Freedom-Valvoline Oil Company have been known for their superlative *quality*. So Freedom-Valvoline safeguards its reputation—its most cherished possession—by shipping its lubricants, rust preventives and other petroleum derivatives in drums equipped with Tri-Sure Closures*.

Tri-Sure Closures have an interengaging *flange, plug and heavy-gauge seal* which give drums absolute security from the hazards of shipping... security from leakage, seepage, substitution and tampering.

When Tri-Sure Closures are on your drums, they express the pride you take in a fine product... they provide insurance against weather and hard handling... and they say to your customers, "here is full value—protected every minute, from loading platform to you."

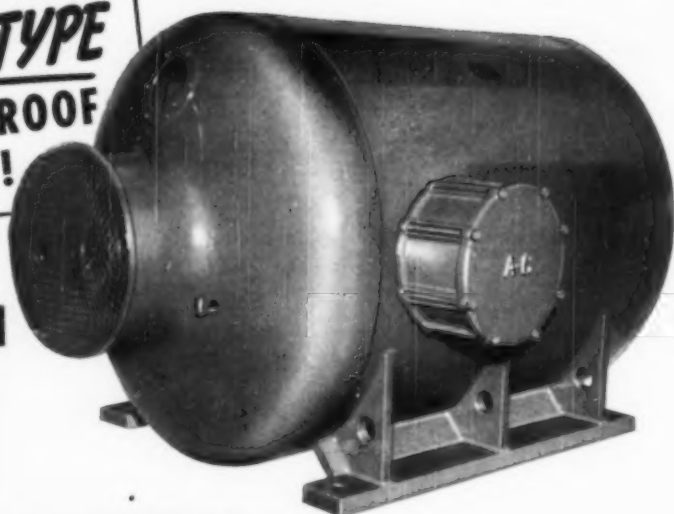
*The "Tri-Sure" Trademark is a mark of reliability backed by 26 years serving industry. It tells your customers that genuine Tri-Sure flanges (inserted with genuine Tri-Sure dies), plugs and seals have been used.

**Play Safe by Specifying
Tri-Sure Closures on Every Drum Order**

AMERICAN FLANGE & MANUFACTURING CO. INC.
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
Tri-Sure Products Limited, St. Catharines, Ontario, Can.



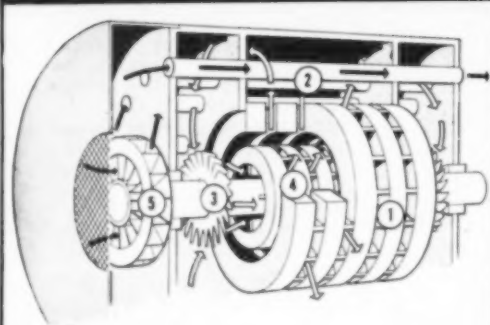
**NEW! *TUBE-TYPE*
EXPLOSION-PROOF
MOTORS!**



CUT COSTS

**IN HAZARDOUS
LOCATIONS!**

How Tube Cooling Works



Stator core (1) is surrounded by tubes (2). Internal fans (3) circulate air through ducts (4) in rotor and stator and around tubes, transferring heat to tubes.

External fan (5) drives outside air through tubes, removing heat and keeping tubes clean. All electrical parts are enclosed. Dirt cannot enter.

- **Practically self-cleaning**
- **Internal forced air circulation provides even cooling**
- **75 hp and up – for 1-D or 2-G locations**

DOWN TIME FOR CLEANING is practically eliminated, and maintenance costs are greatly reduced by the Allis-Chalmers tube-type explosion-proof motor. The heat exchanger has straight tubes, and these unrestricted air passages are kept clean by the air flow through them. Large heat transfer area plus internal and external forced air circulation removes heat quickly.

The performance of this cooling arrangement has been proved by three years of field operation. Sizes from 75 to 600 hp carry Underwriter's label. Larger sizes built on special order. Also TEFC* designs for non-hazardous locations. For complete information, outline your requirements to your A-C Sales Office, or write for Bulletins 05B7150 and 51R7149.

A-2608

ALLIS-CHALMERS, 1147A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS



More, Soon!



Pittsburgh PIPE LINE ENAMEL

NEW PLANT MORE THAN
DOUBLES PRODUCTION



PLANT NO. 2
SOON READY

PLANT NO. 1
OPERATING AT
CAPACITY



From the start, the demand for Pittsburgh Pipe Line Enamel has strained the productive capacity of the plant opened in September, 1948. A new, larger, additional plant, which will more than double our output, is almost completed. By mid-summer we should be able to provide, adequately, for your Tar Base Protective Coating requirements.

Specify *Pittsburgh* Pipe Line Enamel. You can count on its *dependability* and *uniformity* because it is produced from *our own tar* and controlled from start to finish to assure a coating of unsurpassed quality. Address inquiries to:

Tar Base Protective Coating Division
PITTSBURGH
COKE & CHEMICAL COMPANY
Grant Building Pittsburgh 19, Pa.



Sales Representatives:

B. H. MEANS
4111 Marlowe Street
Houston 5, Texas

T. L. HOLCOMBE
1305 Belwood Avenue
Shreveport, Louisiana

An aerial view of the integrated operation of Pittsburgh Coke & Chemical Company where Tar, from our own coal-chemical plant, is made into Pipe Line Enamel.



CUSTOM-BUILT EQUIPMENT

For the Chemical and Food Processing Industries

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STAINLESS

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Fabrication

ACID PLANTS



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PAPER AND PULP
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RAYON PLANTS



TEXTILE PLANTS



PETROLEUM
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DAIRY PLANTS



FOOD PLANTS



MEAT PACKING
PLANTS

ONE UNIT OR CARLOADS

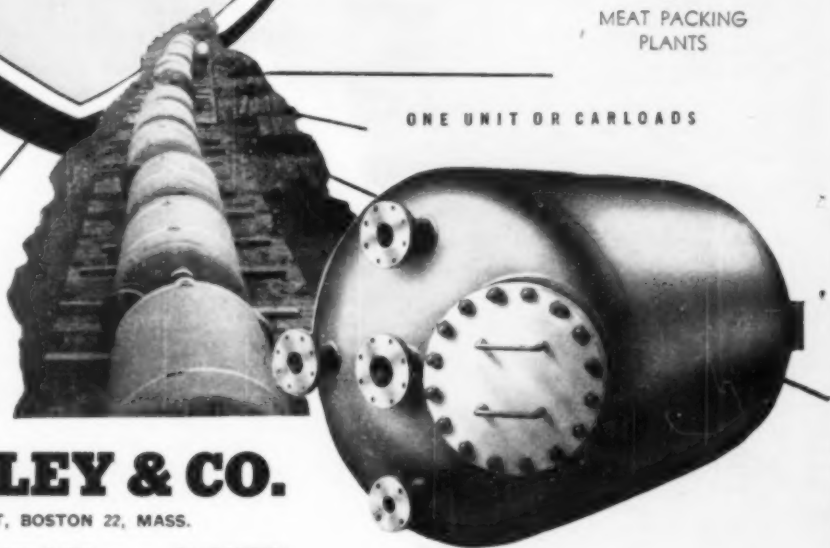
O. G. KELLEY & CO.

94 TAYLOR STREET, BOSTON 22, MASS.

NEW YORK
N. Y.

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ELIZABETH
N. J.





PUBLISHED MONTHLY FOR PROCESS INDUSTRIES EXECUTIVES AND OPERATING PERSONNEL

Early consideration of drying equipment proves profitable on all counts



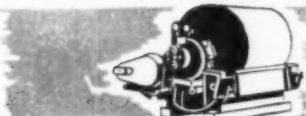
Lower Costs

All of this, of course, adds up to lower costs. When preliminary and subsequent equipment are ordered to dovetail with the dryer and the building plans are made correctly the first time—the savings are tremendous. Even when none of this enters the picture—it is always less costly to consult those who are specialists in solving drying problems—rather than trying to conduct your own research. One manufacturer who stands out because of his misfortune found this out after spending \$20,000. for equipment that was not well suited to his needs. After spending that, he consulted Proctor engineers who recommended just the system that he needed—which they could have done before he had wasted his money.

When you are planning a new product or process where drying is to be part of the line—remember it pays to consider that equipment early and to think of it as a vital link in your over-all process.

Proctor engineers have at their disposal, valuable drying data and complete facilities to help you determine the proper method of drying. By considering this phase of your operation at the very outset, you are sure to save time, money and trouble later on.

Proctor research facilities are available at no cost or obligation to the manufacturer with a drying problem.



Preliminary Equipment

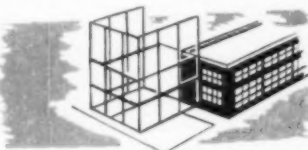
Dryer design is dependent upon the capacity desired and the physical characteristics of the product. In studying a given problem, Proctor engineers may recommend that to obtain the desired capacity the product be delivered to the dryer in a certain state . . . and this may govern the type of preliminary equipment that should be used. Early consideration—before any equipment has been ordered—may well save time, trouble and expense in making the preliminary equipment and the dryer dovetail.



Subsequent Equipment

The characteristics of any given material, when once dried, may affect the type of subsequent equipment that is needed. Only when the material has been dried experimentally can this be determined with any degree of certainty. Where

drying equipment is to be a part of a continuous processing line, it pays to consider the problem as a whole rather than order equipment piece by piece. When this is done at the very outset, all of the equipment can be engineered to dovetail and assure smooth production.



Building Layout

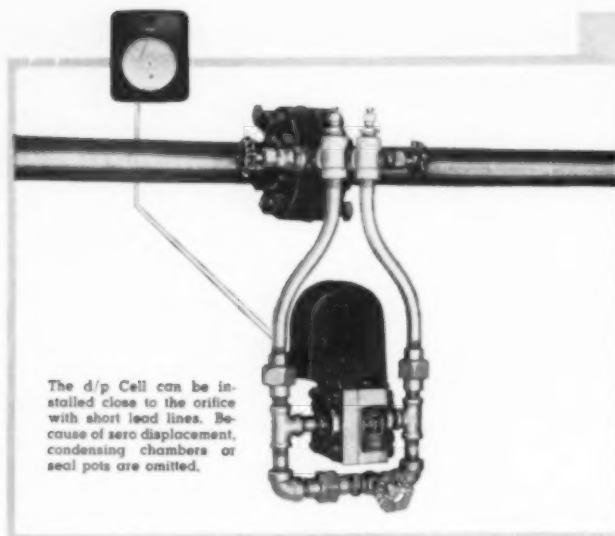
Since huge continuous drying systems are often massive installations—building layout may be affected by the size of the drying equipment needed to meet product and output requirements. When expansion is considered—or an entirely new plant is to be built—it pays to consider drying needs before final building plans are approved. Otherwise the finished building may be impractical to house any drying system. It is always more painless to know for certain that the drying system can be adequately housed and that foundations will support the floor load. The best time to determine all of this is early—before the building has gone too far to change.

Much Proctor drying equipment and textile machinery is covered in full or in part by patents or patents pending.

PROCTOR & SCHWARTZ, INC.

711 TABOR ROAD

PHILADELPHIA 20, PA.



Simpler Flow Measurement

in the palm
of your hand

NEW • REVOLUTIONARY • MERCURY-LESS

FOXBORO DIFFERENTIAL PRESSURE CELL

Now you can simplify many troublesome flow problems . . . especially those where corrosion is a factor or the use of mercury is objectionable. This unique flow measuring device is accurate, easily calibrated, and widely applicable, and it weighs only 20 lbs. The Foxboro d/p Cell offers a combination of advantages that no other type of flow measurement can duplicate.

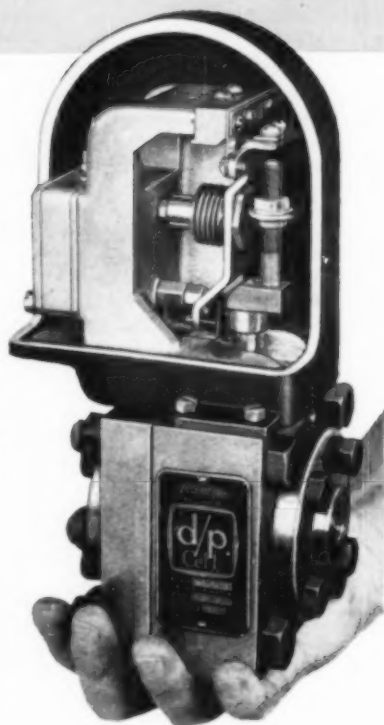
The Foxboro d/p Cell operates on the highly-accurate

force-balance principle, transmitting flow measurement to remote, conveniently-located pneumatic receiving instruments (indicating, recording, controlling). Range: 100 in. to 800 in. Maximum working pressures: 500 psi and 1500 psi.

Get all the facts about this revolutionary new device for the measurement of liquid, steam, gas or air flow. Write for Bulletin 420. The Foxboro Company, 16 Neponset Ave., Foxboro, Mass., U. S. A.

UNIQUE ADVANTAGES

1. Type 316 Stainless Steel Construction.
2. Uses no mercury.
3. Essentially zero displacement—no need for condensing chambers on steam measurement or seal pots on liquid measurement.
4. Immediate, unfailing response to pressure changes.
5. Positive overrange protection.
6. Easy range change.
7. Simple field zero adjustment without disturbing force-balance mechanism.

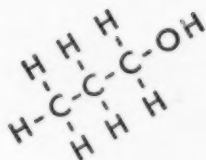


FOXBORO

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RECORDING • CONTROLLING • INDICATING
INSTRUMENTS

CELANESE* n-PROPYL ALCOHOL



lower cost...greater volume

Celanese production of n-propyl alcohol is now meeting large-scale demands. This straight chain alcohol—applicable to processes where its characteristic, excellent solvent action and miscibility can be used to advantage—is available for shipment in drum or tank car amounts.

PHYSICAL PROPERTIES

MOLECULAR WEIGHT	60.09
COLOR	water white
ODOR	characteristic alcohol-like odor
SPECIFIC GRAVITY 20°/4° C	0.8044
DISTILLATION RANGE ASTM °C	2° including true boiling point
WEIGHT PER GALLON 20° C	6.7 lbs.
SOLUBILITY	soluble in water and practically all organic solvents
FLASH POINT open cup	85° F
BOILING POINT 1 atm.	97.2° C
FREEZING POINT	-127° C
VAPOR PRESSURE 100° F	0.9 lbs. per sq. in. absolute
RELATIVE EVAPORATION RATE	1.3 (butyl acetate=1)

If you are looking for an improvement in your products, or short cuts in processing, the straight chain advantages of n-propyl alcohol are worth investigation. n-Propyl alcohol allows the solvent user greater solvent formulation freedom and can be used as a replacement and extender for higher alcohols. Call or write for additional information and specifications and a copy of the newly published Celanese Chemical Brochure.

CELANESE CORPORATION OF AMERICA,
Chemical Division, Dept. 53-F,
180 Madison Avenue, New York 16, N. Y.

Celanese

U. S. P. FORMALDEHYDE

Formaldehyde, one of the most important products in the growing family of Celanese Organic Chemicals, is now offered in greater volume. This high quality, U.S.P. chemical is sold commercially as Formalin, a water white solution containing 40% formaldehyde by volume, 37% by weight. It is obtainable in both methanol inhibited and uninhibited grades.

*Celanese**
CHEMICALS

*Reg. U. S. Pat. Off.

ALDEHYDES • ALCOHOLS • ACIDS • SOLVENTS • GLYCOLS • KETONES • PLASTICIZERS

ELECTRUNITE

STAINLESS STEEL TUBING AND PIPE



ALSO AVAILABLE IN
ADDITIONAL TYPES

- ★ NON-CONTAMINATING
- ★ RESISTANT TO RUST AND CORROSION
- ★ SANITARY...EASY TO CLEAN
- ★ RESISTANT TO HEAT
- ★ EASY TO FABRICATE
- ★ STRONG...LONG LASTING



Your nearby Steel and Tubes Representative will be glad to answer your questions about the proper application of ELECTRUNITE Stainless Steel Tubing and Pipe. Just let us know when you would like him to call.

Pressure tubing for heat exchangers and condensers . . . piping for food, chemical and petroleum processing equipment . . . ornamental tubing for railings, grilles and decorative use . . . these are but some of the countless applications for long-lasting ELECTRUNITE Stainless Steel Tubing and Pipe.

As manufactured by the ELECTRUNITE Process, these modern tubular products are uniformly straight, strong and sound throughout every length and every shipment. And as indicated above, they are available in a wide range of analyses, gauges, sizes and shapes.

For complete information about ELECTRUNITE Stainless Steel Tubing and pipe, write today for a copy of Republic's new 28-page helpful fabricating guide.

REPUBLIC STEEL CORPORATION

STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Dept.: Chrysler Bldg., New York 17, N.Y.



icycle built for "woo"....



Many a proposal was made on a "gay nineties" tricycle. And in that same era—almost a half-century ago—the founders of Niagara Alkali began the first of a long series of important proposals for pioneering and developing the electro-chemicals industry in America.

Something to remember is that this vital pioneering activity that has gone on through the years has given Niagara advanced knowledge and experience that can be of constant benefit to you in the use of Niagara Caustic Soda, Caustic Potash, Carbonate of Potash, EBG Liquid Chlorine, Paradichlorobenzene and Niagathal (Tetrachloro Phthalic Anhydride).

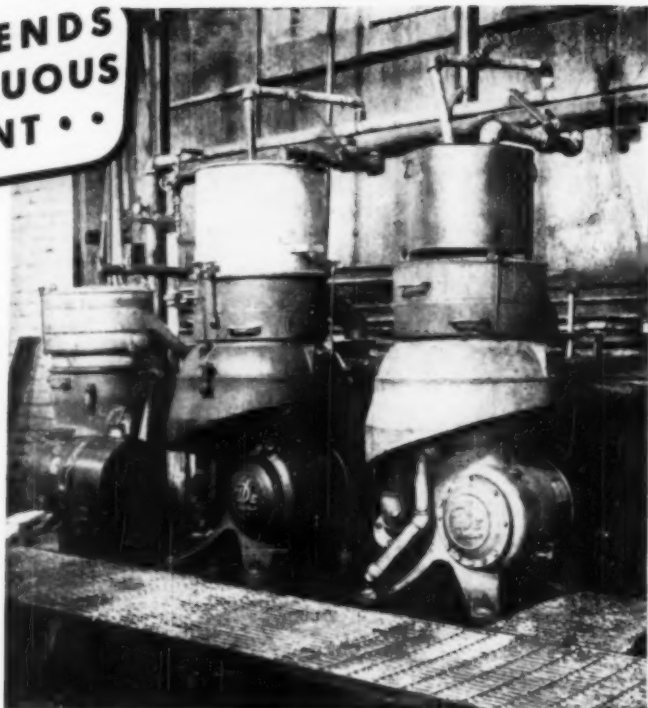


NIAGARA ALKALI COMPANY

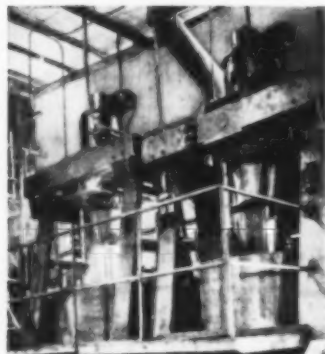
60 East 42nd Street, New York 17, N. Y.

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I PAY DIVIDENDS
AT A CONTINUOUS
SCRAP PLANT ..



.. CAN I HELP YOU?



"I am De Laval Centrifugal Force. At the San Diego plant of the American Processing Company, I separate fish oil from press liquor in "Nozzle-Matic" Separators. And in a De Laval Fish Oil Purifier, I polish and dehydrate the oil.

"In the form of a Meal Extractor, I make possible a recovery of an additional 10 to 15 pounds of dried meal per ton of scrap processed over previous methods used.

"In 1948, when a stick-water plant was built, a De Laval "Nozzle-Matic" and a 48-inch Extractor were installed. The Extractor recovers the fine coagulated meal and the Separator removes the oil from the stick-water so that the evaporators will operate at maximum efficiency."

The American Processing Company is a plant with many applications for centrifugal force. The principles of continuous production emphasized here may well be applied to many other types of plant. Can De Laval Centrifugal Force help you?

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

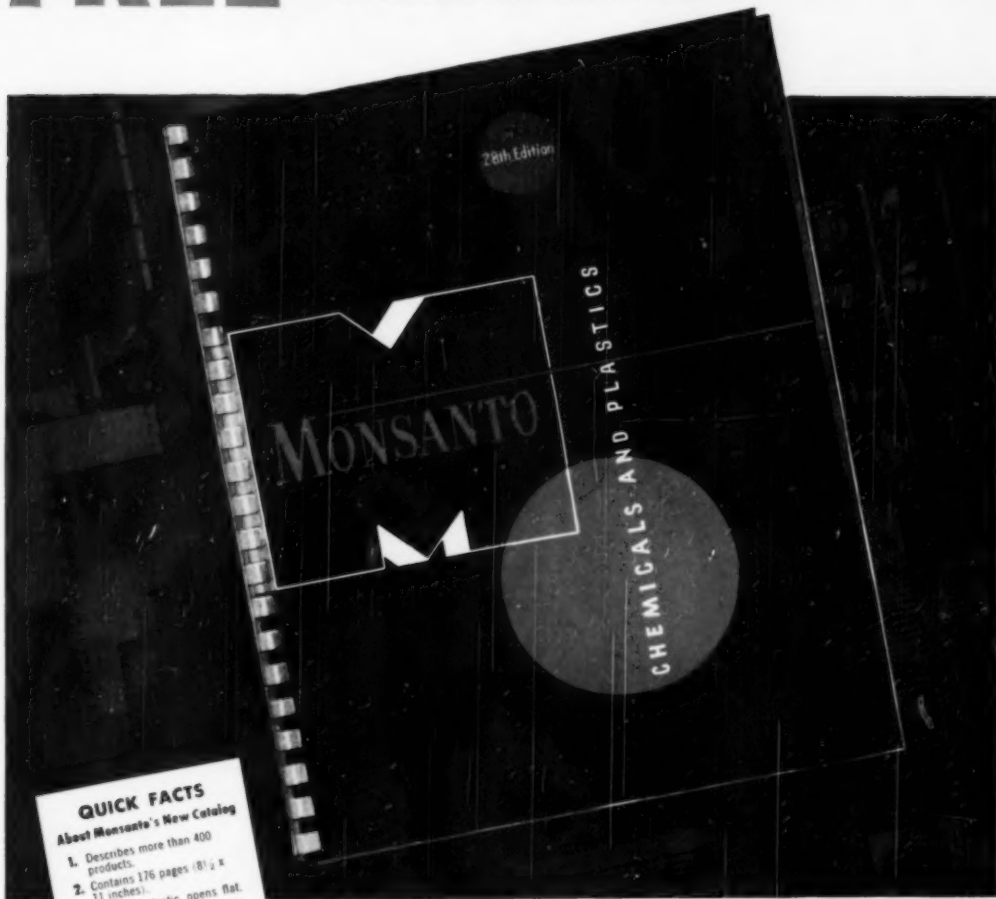
DE LAVAL

CENTRIFUGAL
MACHINES

FOR PROCESSING SYSTEMS ..

FREE

Valuable Reference Book on Chemicals and Plastics



QUICK FACTS

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1. Describes more than 400 products.
2. Contains 176 pages (8 1/2 x 11 inches).
3. Bound in plastic, opens flat.
4. Indexed for easy reference.
5. Contains many useful charts.
6. Has numerous interesting illustrations.
7. Gives useful product data such as:
 - Typical analysis
 - Specifications
 - Grades
 - Standard form
 - Molecular weight
 - Properties
 - Uses
 - Shipping classification

If your business uses chemicals or plastics, ask for your free copy of the 28th edition of "Monsanto Chemicals and Plastics" ... the new Monsanto Catalog, just off the press. It has many improvements over previous editions, making it even more useful to you. The 28th edition is packed with information you will want at your finger tips. Many of its features are listed on your left. For your free and postpaid copy, mail the coupon or write: MONSANTO CHEMICAL COMPANY, Desk F, 1702 South Second St., St. Louis 4, Missouri.



MONSANTO CHEMICAL COMPANY

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SERVING INDUSTRY . . . WHICH SERVES MANKIND



What next...

IN THE past twenty years, Archer-Daniels-Midland Company has played a major part in one of the biggest industrial stories of our time... the chemical conquest and commercial development of the soybean.

Through a broad program of research... and an imaginative quest for new mass markets... and large investments in new plants and equipment... ADM has now helped to make the "wonder bean" as wonderful in practical manufacturing as it is in the laboratory. The story of how soybeans are now utilized in paints, plastics, adhesives, linoleum, livestock and poultry feeds and scores of other products is told in our

new book, "Cracking The Soybean".

But underlying this report there is another important story. This concerns the "ADM Scientific Shortcut". The statement reprinted at the right explains it briefly, and suggests how ADM is now saving manufacturers in dozens of major industries many thousands of dollars.

The facts and forecasts in "Cracking The Soybean" are exciting enough to make any chemist, any business man, ask himself: *what might Soybeans and "the Scientific Shortcut" do for ME?* If you would like a free copy of this book, just mail the coupon at the right.

THE
MEANING
OF

"The Scientific Shortcut"

IN THE 30 years since the end of World War I, a minor industrial revolution has occurred in America. This revolution has greatly changed the methods of the chemical processing industries, and has brought to full development the "ADM Scientific Shortcut."

During this period, chemical technology has advanced in seven-league boots. At the same time, manufacturing companies have become larger and more highly specialized. Competition has become sharper. And the search for faster, more efficient, more economical methods has been greatly intensified.

As a supplier to industry, the Archer-Daniels-Midland Company was quick to see these new demands. In response to them, a broad program was rapidly developed to add three new values to the oils and other products flowing from ADM plants:

1. IDEAS AND INFORMATION, developed by laboratory research; the discovery and development of new products and methods, made available to all users of ADM materials.
2. MANUFACTURING PRE-TESTS, in laboratory and pilot plant, to prove the practical usefulness of all research develop-

ments. This work, which is actual manufacturing in miniature, helps to eliminate guesswork, uncertainty, and trial-and-error for the manufacturer. In scores of instances, this work by ADM has provided a short-cut saving weeks or months of preliminary work for the final processor.

3. EXTENDED PROCESSING of former "raw" materials. Especially in vegetable oils, this development is of greatest importance. For this work, ADM has invested many millions of dollars in new, completely new modifying processes, using heat, pressure, vacuum and reactive chemicals, now deliver many finished oils and vehicles that help manufacturers produce better products at lower cost. Thus, one or more steps of manufacture may be eliminated; the manufacturer's capital investment is reduced; a great amount of time is saved; and excellent quality and uniformity of product is assured.

The term "Scientific Shortcut" is, therefore, an accurate and literal description of ADM's special service to industry. By saving experimental work, pilot plant work and actual manufacturing effort and cost, it helps to create finer end-products faster, with greater certainty, at lower prices.

from Soybeans?

HOW CAN YOU USE *The Scientific Shortcut*?

For specific information on ADM products adaptable to your business, please tell us on the coupon the major types of commodities you manufacture. Technical bulletins and other useful data will be forwarded at once.



MAIL THIS COUPON

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● Please send information on how "The Scientific Shortcut" can be used in the manufacture of _____

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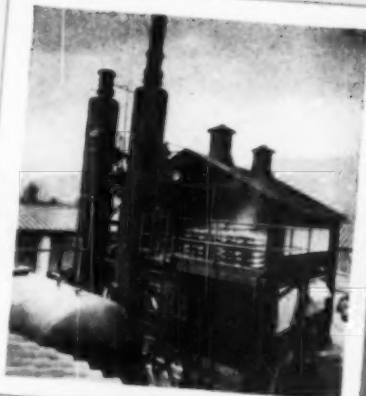
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☐ Please send me a free copy of your new book, "Cracking The Soybean"

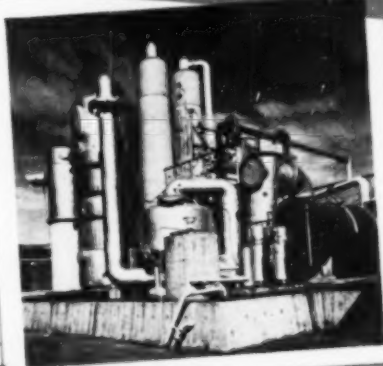
How Much Sulfuric Acid *Do You Want To Produce?*

5 tons per day? 500 tons? Something in between? Whatever your sulfuric acid requirements, Chemico will design and furnish you with a plant tailor-made to fit your needs.

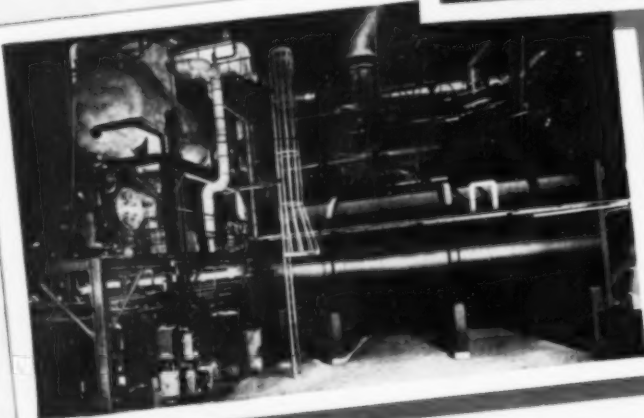
Chemico takes complete responsibility... turns over a highly efficient contact sulfuric acid plant on a one-contract, guaranteed-performance basis. Write for full information.



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PER DAY
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SOUTH
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TONS
PER DAY
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*Chemico plants are
profitable investments*

GD-187

"Give us the tools..."

YOUR ONLY CHANCE of Getting Ahead

Where is the "brave new world" so glowingly promised us by the politicians during and after the war? We were told then that postwar America would live 50% better than it had before. Why has that promise faded out? Why are men today discouraged and frustrated?

We have not yet made good 1944's promises because the *American worker turns out no more in an hour now than he did in 1941*. We are getting more total production in our country—but only because we have more people working. Not because each one of us is producing more. American industry's ability to turn out more and more goods—with less of each worker's time and effort—has been stymied for eight long years.

Progress has been blocked because in some cases workers have not been willing to work as hard as they did before the war. In other cases unions restrict the use of labor-saving machines and methods. In some places obsolete building codes and ordinances prevent advances. In still other cases progress has been blocked by collusive practices between unions and manufacturers or operators.

But the biggest block to progress is the fact that our industry in the United States has been unable to provide our workers with all the new tools and equipment that they need.

Increasing productivity—that is, each one of us turning out more in each hour of work—is the key to higher living standards. Productivity depends directly upon the kind of tools workers use.

His tools, more than anything else, determine how much a worker can turn out; and what his paycheck will buy depends in large part on what he turns out—not on how long or how hard he works.

Look what happened in our country in the forty years from 1900 to 1940. Productivity of the United States *more than doubled*. It doubled because:

Business investment in capital equipment gave workers new tools—tools that had three and one-half times as much power—

So—Americans' living standard rose almost 50% while the average work week was dropping from 61 to 43 hours.

Industry did continue to raise its output per man hour, even in the depressed 1930's. But it did it because, with unemployment widespread, companies used only their most efficient equipment. *Actually the great depression saw industry fall far behind in the job of providing workers with new tools.*

Then came World War II. Few new tools for peacetime industry were produced. *As a result of depression and war, the U.S. fell behind in needed investment in new industrial facilities by more than \$100 billion.*

Since the war business has spent almost \$60 billion for new plants and equipment—

But the greater part of that money went to *expand* production to take care of the needs of our bigger population, and to *replace* plants and equipment that were worn out and ready to be junked at the end of the war.

continued on next page

Only a small fraction of the \$60 billion went to *modernize equipment* — the equipment that increases efficiency and improves productivity of the individual worker.

Right now industry is desperately trying to do the job of increasing efficiency of machines so that each worker can turn out more.

McGraw-Hill's national survey of Business' Needs for New Plants and Equipment shows that manufacturers plan right now to spend in the 5 years ahead three-quarters of their capital funds to replace and modernize facilities. The biggest part of the more than \$55 billion industry plans to spend on its plants and equipment will go directly to improve efficiency of the individual.

If industry can carry through its plans — and expand them as it would like to and as it must do — the U. S. can catch up on its depression-war-time lag in progress within a few short years.

If American industry is allowed to earn the money to buy the equipment, it can raise the American standard of living 50% in our generation — in the next 25 years. No other nation can promise its people that much — and deliver on the promise.

But the promise can only be fulfilled by American industry. Wherever you turn, industry has dramatic new ways of doing things. Using oxygen by the ton, steel makers are increasing production from blast furnaces by 20%. New high-speed machine tools are doing three times the work of 1940 tools. A new coal-mining machine will multiply a miner's daily output 10 times. Diesel locomotives do the work of three steam locomotives on many jobs.

New products — and larger production of standard products — are already making their impact on American life. Two million Americans will get new television sets this year. Automatic washing machines, electric dishwashers, and home freezers are easing the daily tasks of thousands of housewives. Millions of homes that did not have them before the war now have telephones, automatic heat and refrigerators. Frozen foods, nylon clothing — these and many other things

coming along now — will shape the *real* new world for Americans.

But industry can provide them only if it can keep on investing at least \$15 billion a year now — and more in future years — in new plants and equipment.

Today Washington is taking a course which, if pursued, will make that investment by industry impossible. Government spending now strains our resources to the limit, and more multi-billion dollar spending proposals are being piled on. *But government spending cannot improve American living standards.* It never has, and it never will. Increasing government spending *now* will only block progress, because the government proposes to pay for its plans by taxing away the profits industry is using, and must continue to use, to improve and expand its plants and equipment — our only hope for greater worker productivity and higher living standards.

Better living can only be paid for with more production. And we can only get more production by increasing productivity — by each one of us producing more for each hour of work.

The first thing is to get the production — in peace and in war — for better living — for security. Industry is planning to provide it — and is using \$13 billion of its profits this year to improve and expand its facilities.

The only sensible, the only safe national policy is to make it possible for American industry to do its job — not to terrorize private industry with proposals of ruinous taxation and paralyzing controls and threats of nationalization. For American industry is not a thing apart from the American people any more than is government. American industry is the lifeblood of the American people and whatever makes industry do its work better contributes more to the common welfare than a bureaucratic government can ever hope to do.



President, McGraw-Hill Publishing Company, Inc.

NEW CATALOG

Just off the Press

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YOUR COPY

Versatile
MIXCO
CATALOG B-89

HEAVY DUTY
TURBINE AGITATOR
For Open or
Closed Tanks

MIXING EQUIPMENT COMPANY, INC.
1028 GARSON AVE.
ROCHESTER 9, N. Y.

PROCESS ADAPTED
AGITATION

LIGHTNING
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Solve Your Mixing Problems the Versatile Mixco Way

NEW BULLETIN B-89

1. Gives you details on the new drive which makes shaft flexure from gear.
2. Gives details on versatility.
3. Gives details on various impellers.
4. Gives complete specifications.
5. Shows how you can standardize with Mixco.

Mixco Heavy Duty Turbine Agitators (for open or closed tanks) are delivered as a complete packaged unit ready to install and run.

1. Remove from shipping case (no loose parts).
2. Lower onto tank, bolt into place (no welding—self supporting).
3. Connect current and start operating.

Read about how a single time and labor saving Mixco can be used in a variety of installations. It's all contained in new bulletin B-89.

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SEND IN THIS COUPON NOW!

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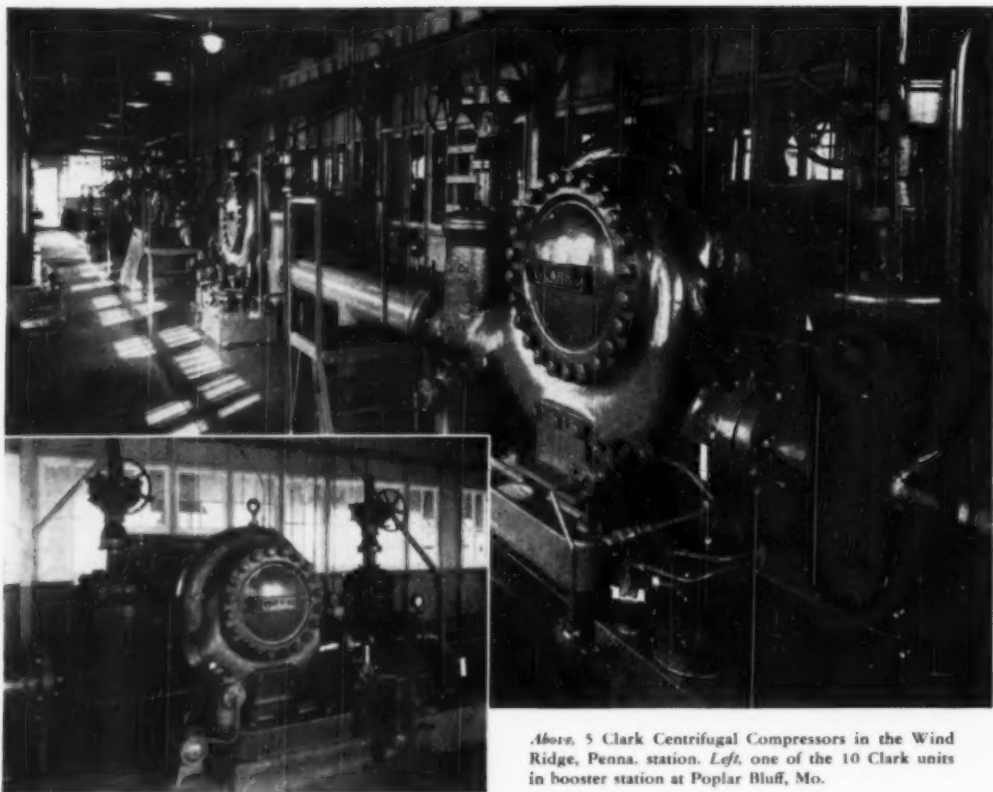
Please send me your new bulletin B-89

Name

Title

Address

City State



Above, 5 Clark Centrifugal Compressors in the Wind Ridge, Penna. station. Left, one of the 10 Clark units in booster station at Poplar Bluff, Mo.

CLARK CENTRIFUGALS handle large volumes of gas efficiently... **DESIGN FEATURES DEPENDABLE SEAL**

Fifteen Clark Centrifugal, single-seal pipe line boosters are handling large volumes of gas at high pressure in the Texas Eastern Transmission Corporation's booster stations at Poplar Bluff, Missouri, and Wind Ridge, Penna.

Reliable performance, quietness of operation

and ease of accessibility to internal parts characterize these new Clark units.

Adequate, dependable sealing is achieved by the floating sleeve, oil-film-type seal which is an exclusive Clark feature.

Write us about your compressor requirements.

CLARK BROS. CO., INC. • OLEAN, NEW YORK

Birmingham, Ala. • Boston • Chicago • Detroit • Houston • Los Angeles • New York • Salt Lake City • San Francisco
Tulsa • Washington • London • Paris • Bucharest, Rumania • Caracas, Venezuela • Buenos Aires, Argentina

CLARK

ONE OF THE DRESSER INDUSTRIES

Whatever type of Compressor
you need, **CLARK MAKES IT**

DEPENDABLE POWER



Save TIME...SPACE...MONEY...with Battery Electric Trucks and **EXIDE-IRONCLAD BATTERIES**

You gain in many ways when your materials are handled the efficient, modern way—in UNIT LOADS by Battery Electric Trucks. Goods move faster and in greater volume. More storage space can be utilized by higher tiering. Handling costs are reduced . . . often as much as 60%. And when the batteries are Exide-Ironclads, you can count on minimum power costs and full shift availability.

EXIDE-IRONCLAD BATTERIES are DIFFERENT . . . in construction . . . in performance. They have ALL FOUR of the characteristics a storage battery must have to assure maximum performance from battery electric industrial trucks—high power ability, high electrical efficiency, ruggedness, and a long life with minimum maintenance. This combination assures years of day-in, day-out service with dependability, safety and economy.

Write for further particulars and FREE copy of Exide-Ironclad Topics, which contains latest developments in materials handling and shows actual case histories.

1888 . . . Dependable Batteries for 61 Years . . . 1949

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 22
Exide Batteries of Canada, Limited, Toronto



HYDRO-ELECTRIC LIFT TRUCK



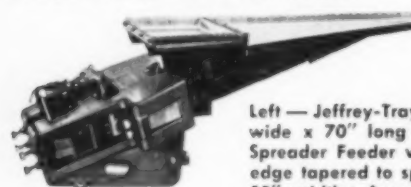
HYDRO-ELECTRIC LIFT TRUCK

"Exide-Ironclad" Reg. Trade-mark U.S. Pat. Off.

DRYING-COOLING by Conveying Action

Employing the principle of vibration, Jeffrey-Traylor Dryers and Coolers are ideal for handling material through various processing zones—from step to step. The Direct and Indirect types are shown here. These systems are unexcelled for handling friable, dusty, or chemically-pure material without contamination, breakage, loss of color or lustre. Difficult clean-up eliminated.

For fine materials—solid conveying surface (above). Either jacketed for steam, hot air or other gases, or is heated by direct flames or burners. Indirect-type Coolers are either jacketed for water, brine or cold air—or are sprayed.



Left — Jeffrey-Traylor 14" wide x 70" long tapered Spreader Feeder with one edge tapered to spread to 55" width. Arranged for automatic vibration control. Various styles and sizes with stainless steel or cast aluminum decks.

These Dryers and Coolers are valuable for processing under closely controlled conditions — material may be conveyed by vibration in thin layers and at controlled rate. Automatically controlled at each setting — assures desired time and depth of exposure to the drying medium at each point in the drying process. We build "custom-built" systems to suit particular conditions — make them in standard lengths, each independently powered. Sections arranged in right combination for any job. For Drying and Cooling — see Jeffrey



Typical HD 33D Jeffrey-Traylor Direct-type Cooler section. Cooling by direct contact with cool air — passes upward through bed of material as it travels over the finely perforated or louvered conveying surface—uniform heat transfer from solid to air producing rapid cooling.

Feeders
Dryers
Coolers
Conveyors
Screens
Barrel Packers
Packing Tables
Bin Valves
Bin-Level Controls
Waytrols

THE JEFFREY

MANUFACTURING COMPANY Established 1877

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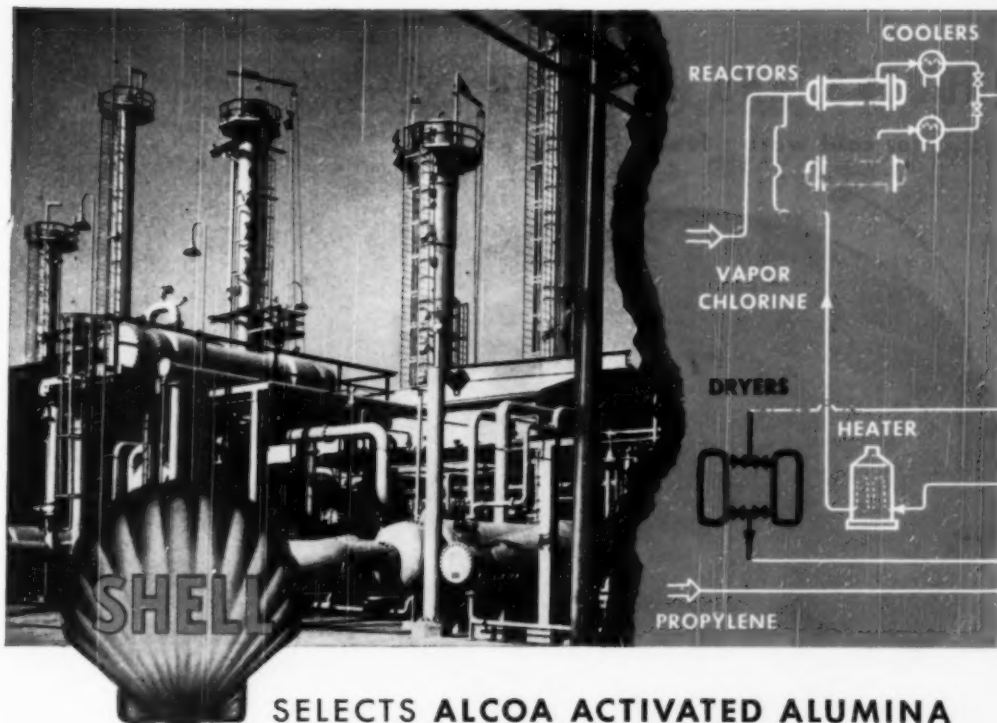
Jacksonville 2
Milwaukee 3
New York 7
Philadelphia 3

Pittsburgh 22
St. Louis 1
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Complete Line of
Material Handling,
Processing and
Mining Equipment



For Jeffrey-Traylor Equipment in Great Britain: — Lockers (Engineers) Inc., Warrington, England.



SELECTS ALCOA ACTIVATED ALUMINA FOR WORLD'S FIRST SYNTHETIC GLYCERINE PLANT

Close control of reactions is one of the many secrets of success in Shell Chemical Corporation's new synthetic glycerine plant. The raw material, propylene, must be quite pure as well as dry. Side reactions which introduce extraneous compounds make the desired reaction more difficult to complete.

It is essential, therefore, that the desiccant used for drying the raw material must, itself, be *pure, uniform and highly inert*. Such specifications as these are met every day by the regular production quality of ALCOA Activated Alumina—the desiccant which Shell selected for their unique process.

ALCOA Activated Alumina is a commercially pure chemical. It adsorbs water without objec-

tionable changes in form or properties. It does not swell, soften or disintegrate. ALCOA Activated Alumina has high resistance to shock and abrasion, is non-corrosive and practically iron-free.

ALCOA Activated Alumina dries gases, vapors and organic liquids to dew points as low as *minus 100° F.* Yet its stability and purity make it an economical desiccant where higher dew points suffice.

Why not get *all* the facts regarding this outstanding drying agent? We'll gladly furnish you with complete information. Write to: ALUMINUM COMPANY OF AMERICA, CHEMICALS DIVISION, 1778 Gulf Building, Pittsburgh 19, Pennsylvania.



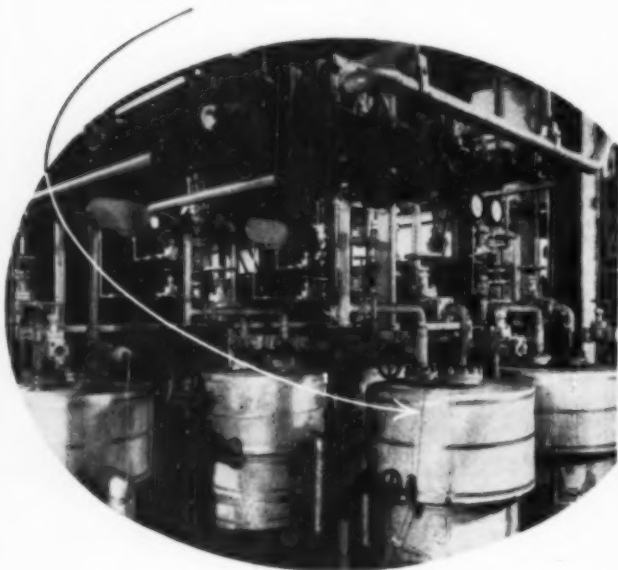
ALCOA CHEMICALS

ALUMINAS AND FLUORIDES

ACTIVATED ALUMINAS • CALCINED ALUMINAS • LOW SODA ALUMINAS • TABULAR ALUMINAS • HYDRATED ALUMINAS
ALUMINUM FLUORIDE • SODIUM FLUORIDE • SODIUM ACID FLUORIDE • FLUOBORIC ACID • CRYOLITE

INDOORS AND OUTDOORS

for cold work • for hot work



PC FOAMGLAS

-the permanent insulation



This is FOAMGLAS®

The entire strong, rigid block is composed of millions of sealed glass bubbles. They form a continuous structure, so no air, water, vapor or fumes can get into or through the Foamglas block. In those closed glass cells, which contain inert air, lies the secret of the material's permanent insulating efficiency.

For additional information see our inserts in Sweet's Catalogs.

● This rugged insulating material will help you to maintain a wide range of desired temperatures on outdoor and indoor tanks, towers, retorts and other large vessels. It has proved effective also on hot and cold piping, heat exchangers, evaporators and other processing equipment.

PC Foamglas is a true glass in cellular form. Therein lies the secret of its excellent insulating properties. Being glass, it is moisture-proof, fireproof, and acidproof . . . does not rot, check, warp, swell or shrink. When installed according to our recommendations and specifications, PC Foamglas retains its original insulating efficiency permanently.

When you are figuring on insulation, be sure you have the latest information on PC Foamglas. Our insulating specialists will be glad to consult with you, to determine where and how you can use PC Foamglas most effectively and economically. Just drop a line, without obligation, to Pittsburgh Corning Corporation, Dept. R-69, 307 Fourth Avenue, Pittsburgh 22, Pennsylvania.



FOAMGLAS INSULATION

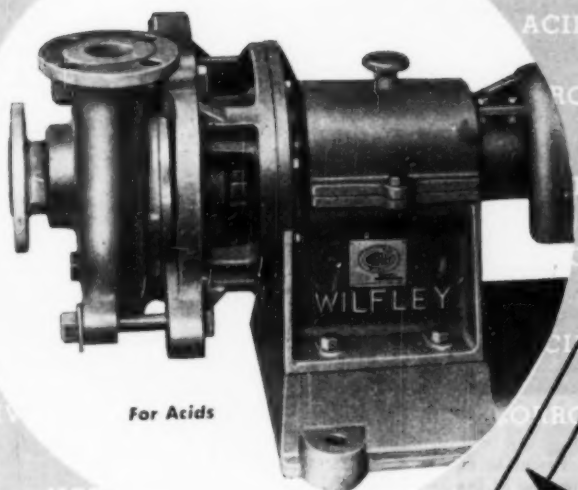
*When you insulate with Foamglas
...you insulate for good!*

WILFLEY ACID PUMPS PRODUCE

Substantial Savings

IN ACIDS • HOT LIQUIDS • CORROSIVES

OPERATING COSTS



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A Companion
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Buy WILFLEY for
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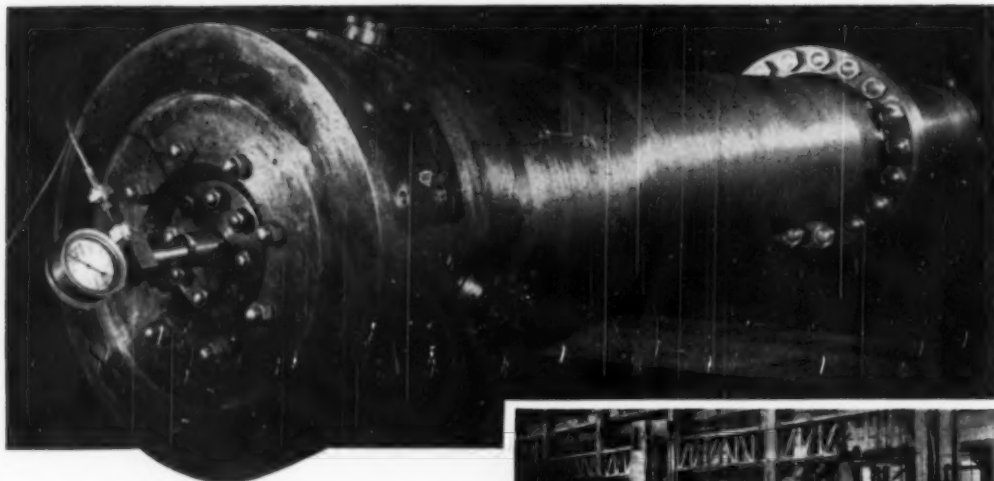
All over the world, in chemical plants where accurate cost records are kept, WILFLEY Acid Pumps are a major factor in holding operating costs down to the lowest possible level. Exclusive features of design and construction make WILFLEY the dependable cost-reducer wherever acids, corrosives, hot liquids or mild abrasives must be handled on a trouble-free, 'round-the-clock schedule without attention. 10- to 2,000-G.P.M. capacities; 15- to 150-ft. heads and higher. Individual engineering on every application. Write or wire for specific information.

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NEW YORK OFFICE: 1775 Broadway, New York City

WILFLEY *Acid* **PUMPS**

BETHLEHEM

Builds the Pressure Vessel You Want



A request for a small, special-type vessel is as welcome in our shops as an order for one of the heavyweights. Bethlehem can handle either to your satisfaction. Our engineers will work with you from the ground up, and our well-equipped forge and machine shops will follow specifications to the letter.

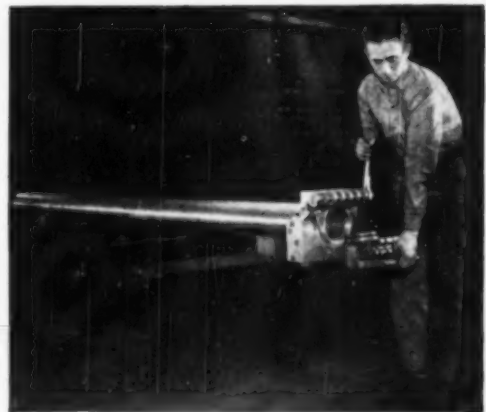
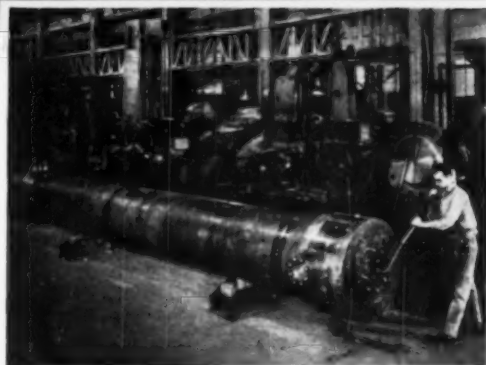
Shown here are three Bethlehem forged-steel high-pressure vessels that differ greatly in size. The big fellow, a two-piece job, weighed 77 tons. At the other extreme, the small, slim vessel with the special head grossed less than half a ton. The medium-sized unit was somewhere in between.

The point is, Bethlehem-made vessels are not confined to any one size or type. We're always glad to do a custom job to your specifications, using carbon or alloy steel, whichever you choose. All Bethlehem vessels are rugged seamless forgings, and jobs can be partially or completely machined, as ordered. Your inquiries are invited.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation



One of the many ways that
industry makes multiple savings
with Gulf Quality Oils and Greases:



GULF NO-RUST NO. 3

*prevents corrosion on polished steel surfaces—
saves refinishing costs on overseas shipments*

Paper machine dryer and calendar rolls must have a mirror-like surface to produce fine papers with a uniform, blemish-free finish.

An important foreign customer of a New England paper equipment manufacturer reported corrosion and pitting on its dryer rolls during transportation overseas. A regrinding operation was necessary before the rolls could be put in service. Effective protection against corrosion had to be found!

A Gulf Lubrication Engineer was consulted and his recommendations were followed to the letter. Result: corrosion entirely eliminated, regrinding costs saved, the customer completely satisfied!

Here are the suggestions made by the Gulf Lubrication Engineer: (1) clean surface with Gulf Stoddard

Solvent; (2) apply Gulf No-Rust C (Polar type) to displace residual moisture; and (3) coat with Gulf No-Rust No. 3 to provide heavy protecting film against corrosion during overseas shipment.

Gulf offers a complete line of oil- and petrolatum-type rust preventives from which you can select the proper coating to fit the desired method of application, type of metal, length of time for which protection is required, conditions of storage or shipment, and ease of removal. Write, wire, or phone your nearest Gulf office today and ask a Gulf Lubrication Engineer to call.

Gulf Oil Corporation • Gulf Refining Company

Division Sales Offices:

Boston • New York • Philadelphia • Pittsburgh • Atlanta
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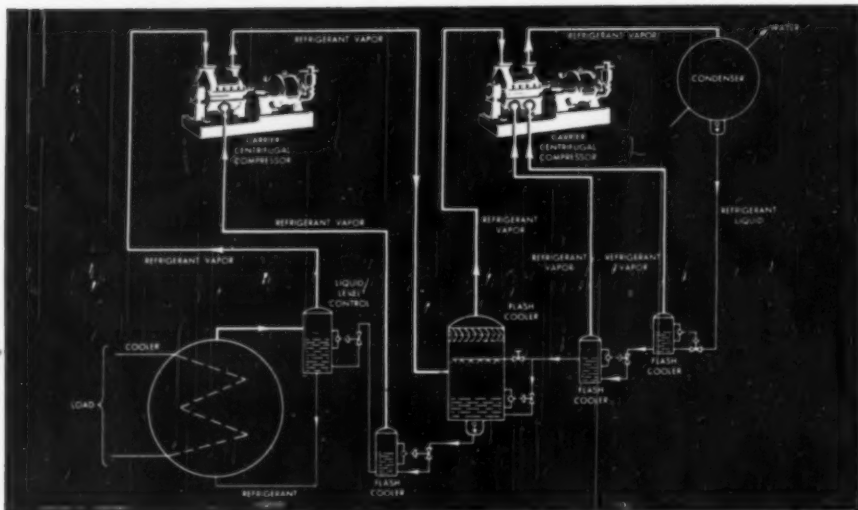


**Helps make machines
produce more at lower cost**

PROBLEM:

How to attain ultra-low temperatures economically

SOLUTION:



THIS DIAGRAM shows the use of Carrier Centrifugal Compressors staged in a low-temperature refrigerating cycle employing hydrocarbons or halogenated hydrocarbons as refrigerants. This application of Carrier Centrifugals has been proved exceptionally economical and efficient in many leading plants.

The design of these compact, dependable units provides many advantages, among them:

- 1 No expansion valves or reciprocating mechanism to create problems at ultra-low temperatures.
- 2 Because the bearings are located outside the gas passages, difficulties with lubrication are at a minimum. This same design feature also improves efficiency by virtually eliminating oil fouling of heat-exchanger surfaces.
- 3 Carrier Centrifugals require no expensive foundations and can be operated without housing.
- 4 Rotative design assures low operating and maintenance cost.

- 5 The installed cost is low and the units can be easily and quickly placed in service.

Besides straight series staging, Carrier Centrifugal Compressors are used in cycles involving a cascade arrangement where full advantage is made of the thermodynamic properties of two refrigerants. This results in reduced exchanger surface and higher efficiencies.

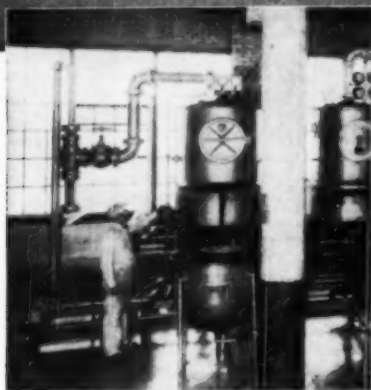
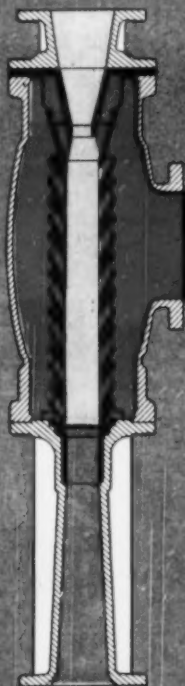
Designed and built in the same tradition of leadership that developed rotative refrigeration more than a quarter of a century ago, Carrier Centrifugal Compressors give long life with low-cost, efficient service. As a result of their proved performance, more of these Carrier-designed machines have been sold than any other kind. They are now available for prompt delivery. For full facts, call your nearest Carrier representative, Carrier Corporation, Syracuse, New York.

Carrier

CENTRIFUGAL COMPRESSORS • REFRIGERATING EQUIPMENT

Get...

**THEN FORGET
THIS
EDUCTOR
CONDENSER**



Three SK Eductor Condensers, only one of which is shown, are used on vacuum kettles in the food manufacturing plant above.

The SK Eductor Condenser has no moving parts to get out of order, adjust or repair. It's simply designed to require minimum maintenance and insure efficient operation in various processes requiring medium or high vacuum. You can install it and then forget it.

In operation, the injection water is delivered to the top inlet of the condenser at a constant pressure of 10 lbs. which, combined with the internal vacuum, produces sufficient jet energy to discharge the water through the tail diffuser against atmospheric pressure. The water jet condenses the steam, entrains the non-condensable gases and discharges the mixture into a hotwell tank without the use of an external vacuum pump.

Ideal for use with small engines or turbines and in process operations in the food, chemical and refinery fields, SK Eductor Condensers are made in sizes ranging from 1½" to 10" inclusive.

You can get full details on construction and operation by requesting Bulletin 5-B.



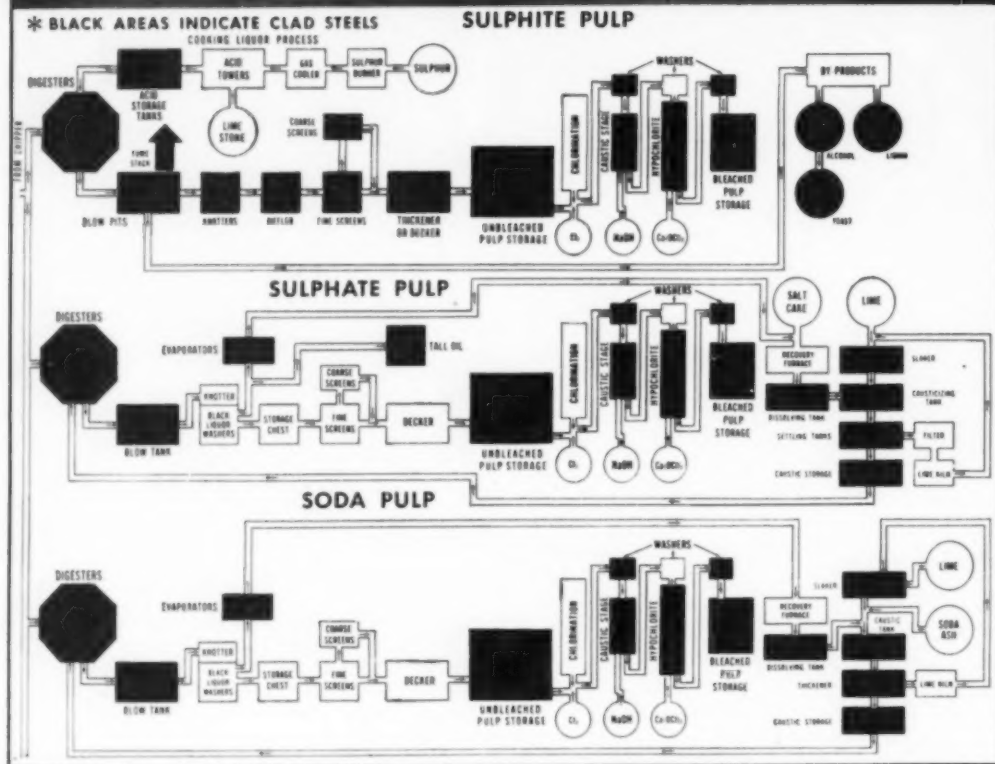
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Manufacturing Engineers

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Applications for *Clad Steels*^{*} in Paper-Pulp Making



Lukens Clad Steels—Nickel-Clad, Stainless-Clad, Inconel-Clad and Monel-Clad—are serving at many locations in the Pulp and Paper Industry, providing solid corrosion-resistant metal protection at the lower cost of clad steels. Your suppliers of processing equipment are familiar with their advantages. Many companies have standardized on Lukens Clad Steels wherever they have en-

countered trouble with corrosion.

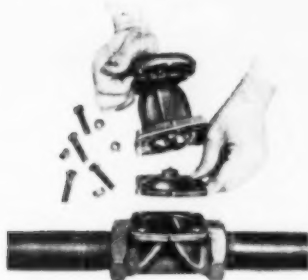
The new Bulletin 470, "Product and Equipment Protection for the Pulp and Paper Industry", is just off the press. For a copy and for help on your corrosion problems, write Lukens Steel Company, 400 Lukens Building, Coatesville, Pennsylvania.



LUKENS
Nickel-Clad Stainless-Clad
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STEELS

SOLID METAL ADVANTAGES WITH CLAD STEEL ECONOMY

Easy as fixing a faucet



THE GRINNELL-SAUNDERS DIAPHRAGM VALVE has only one part that normally wears and needs replacement . . . the diaphragm. Depending on the type of service, it may last for years or only months. It can be replaced in just a few minutes. The valve body doesn't have to be removed from the pipe line . . . only the bonnet. The new diaphragm is attached to the bonnet which is then bolted back onto the valve body . . . and the valve is restored to service. That's all the maintenance a Grinnell-Saunders Diaphragm Valve normally needs. No packing glands to demand frequent attention. No refacing or reseating required, because there are no metal-to-metal seats to become damaged or wire drawn.

SIMPLE, POSITIVE OPERATION . . . Flexible diaphragm opens wide for streamlined flow, pinches tight for positive closure even when grit, scale or other solid matter is trapped on the weir.

NO CLOGGING . . . MINIMUM RESISTANCE TO FLOW . . . Smooth, streamlined fluid passage without pockets prevents accumulation of sludge and reduces friction resistance to a minimum.

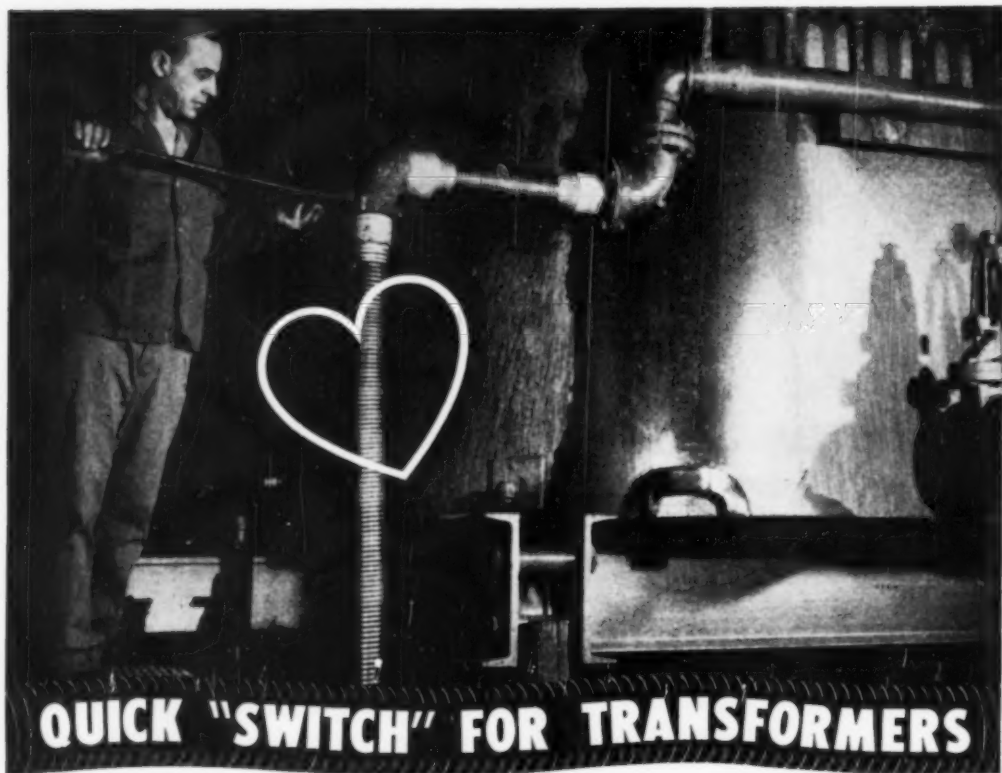
NO CORROSION . . . NO CONTAMINATION . . . NO LEAKS . . . The working parts of the valve are completely isolated from the fluid by the diaphragm. Diaphragm materials, body materials and body linings are available to suit service requirements.

Available in various combinations of valve bodies and operating mechanisms. Write for catalog.



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Grinnell Company, Inc., Providence, Rhode Island. Branches: Atlanta • Buffalo • Charlotte • Chicago • Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach • Los Angeles • Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane



QUICK "SWITCH" FOR TRANSFORMERS

**Penflex metal hose cuts replacement time $\frac{1}{2}$
... reduces costs... speeds power resumption**

Replacing faulty 220,000-volt transformers in a mammoth hydro-electric power station became a lengthy, troublesome task for one Eastern utilities company. When one of these 12 giants needs repairs, a spare has to be put in its place and quickly connected to cooling water pipes before resumption of service.

But since no two transformers are precisely alike, it was difficult to line up pipe flanges for bolting. Often special "wedges" had to be machined and inserted to obtain tight sealing... pipes had to be heated and bent... power output was delayed.

Troubles soon disappeared when Penflex engineers recommended 4" bronze interlocked flexible metal hose assemblies. Now, transformers are switched in

almost $\frac{1}{2}$ less time. Connections are quickly made because flexibility of hose allows for misalignment. Special machining and bending operations are eliminated... power is speedily resumed... man-hours reduced.

Penflex "Flexineering" (the science of engineering each type of flexible tubing to the problem) can help you iron out production wrinkles easily, economically. It will pay to know more about Penflex tubing layout service, streamlined for quick solution to your problems on flexible transmission of liquids, air, gases, or light solids. For complete service on flexible hose, tubing and couplings from $\frac{1}{8}$ " I. D. to 30" I. D., write today to...



PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.

7234 Powers Lane

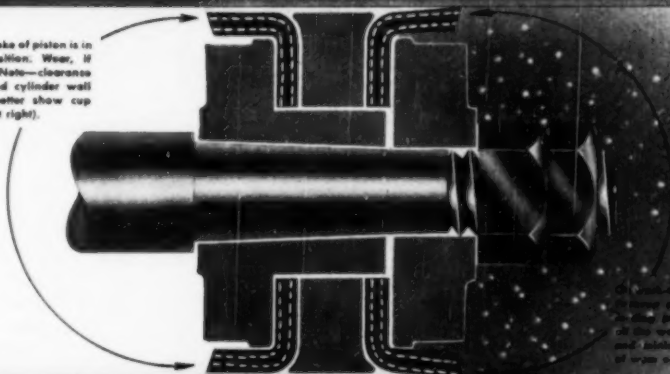
Philadelphia 42, Pa.

Branch Sales Offices—BOSTON • NEW YORK • CLEVELAND • CHICAGO • HOUSTON • LOS ANGELES

Penflex... HEART OF INDUSTRY'S LIFE LINES

Copyright 1948—Penflex Sales Co.

Pumcup on return stroke of piston is in relaxed, normal position. Wear, if any, is negligible. Note—clearance between Pumcup and cylinder wall is exaggerated to better show cup action under load (at right).



On load stroke, fluid pressure forces cup against cylinder wall, achieving pressure-equalized contact at one very round, uniform wear, and minimum leakage regardless of wear on the cup.

PUMP PISTON MOTION

NEW RETIREMENT PLAN...

for piston packing

WHAT is the "retirement age" of the piston packing in your reciprocating pumps, or in your air or hydraulic controls? A day? A week? A month?

Think what you could save in maintenance expense, in costly shutdowns, with a packing that does a perfect job 5, 10, or even 100 times as long. That's exactly what Darcova Pumcups are doing in thousands of installations where they have replaced leather crimps, ring packing, metal or plastic rings, or other ordinary packing.

How? First, the drawing above shows how the cup principle, scientifically applied the Darcova way, minimizes friction, equalizes and re-

tards wear. Second, Pumcups are made of a special, Darcova-developed composition, exceptionally wear-resistant and immune to tough pressure and temperature conditions. Third, Pumcups are precision-built in many different textures, each absolutely uniform. Fourth, despite wear, high volumetric efficiency is retained for the life of the packing.

So, if you're not using Darcova Pumcups, you're in line for a new piston packing "retirement plan"—one that will save you plenty of time, trouble and expense. For a free bulletin containing complete information, write, or use the coupon below.



Darcova Pumcups are made in standard sizes from 1/2 to 42 inches in diameter, are easily installed in any reciprocating pump or air or hydraulic mechanism to replace ordinary packing. They handle virtually any fluid under a wide range of pressure and temperature conditions.



DARLING VALVE & Manufacturing Co.
WILLIAMSPORT, PA.

Darling Valve & Mfg. Co., Williamsport 3, Pa.

Please send me the free bulletin checked below:

- ☐ No. 4401 Darcova Pumcups for reciprocating pumps.
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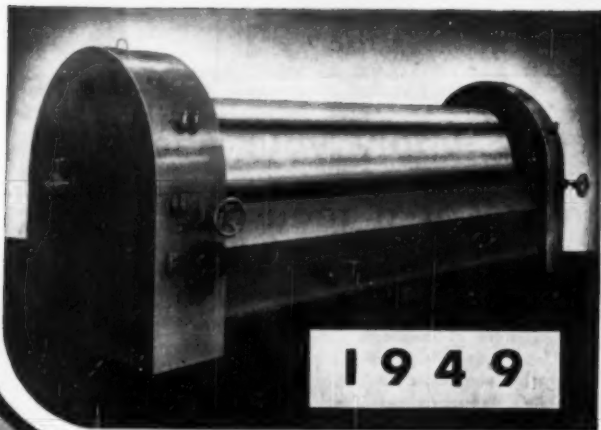
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... FOR A LONGER LIFE

QUAKER CONVEYOR BELTS PRE-TESTED 18 TIMES TO ASSURE LONG LIFE UNDER MOST SEVERE CONDITIONS

Chemicals...slag...ore—some hot, some cold and case histories prove Quaker Belts stand up under the most severe usage. They're pre-tested and torture-tested when they are made to withstand every operating condition.

One of the many tests Quaker Conveyor Belts must go through is shown above. A blowtorch, at high heat, held six inches from the surface of the belt for six minutes. Quaker Belts take it and are ready for more. They're tough, rugged and built for longer wear. They're made for the chemical industry to assure less maintenance...to save loss of labor in repairs...to help your plant reduce the "break-even point" in its operations.

Whatever your need for industrial products there's a Quaker Pre-tested Product for the Chemical Industry. Power transmission belting for every type of installation...rod and sheet packings...and moulded and braided hose. To economize...it pays to Quakerize your plant.

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Hose for air, steam, water, oil, gas, chemicals, fire, or paint. Quaker makes it and makes it to fit the particular needs of the chemical industry...each length pre-tested for peak performance.

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Quaker Packings are scientifically engineered for every use—for pumps, refrigeration, compressors, water lines, valves and many other places in the chemical industry. Each pre-tested for positive performance.

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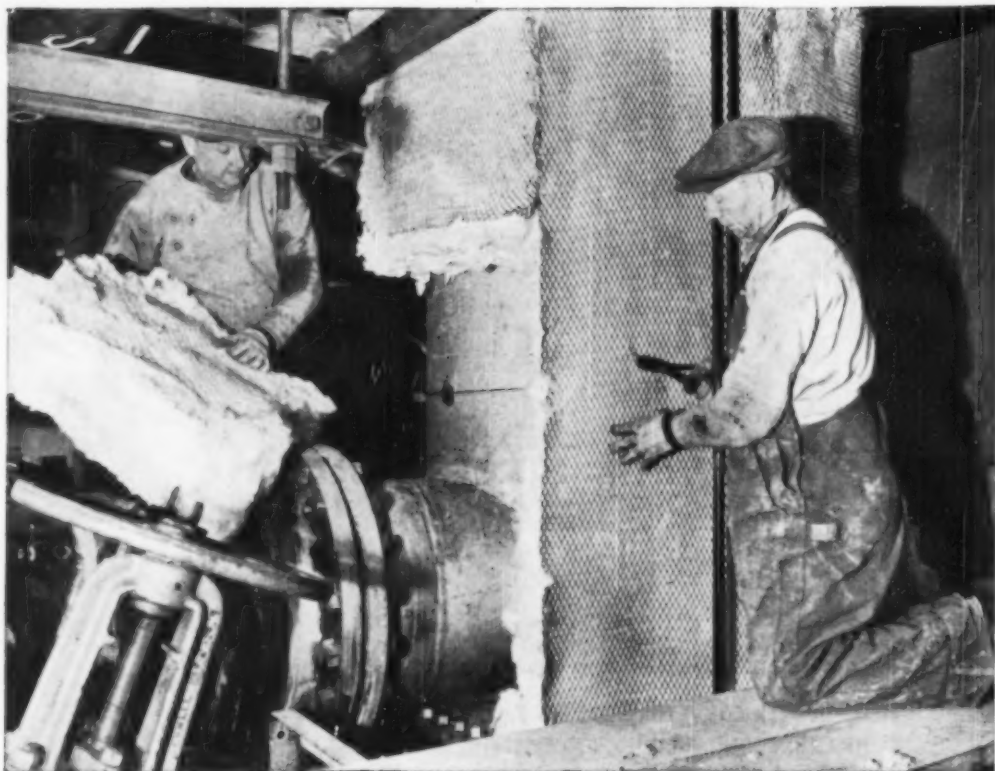
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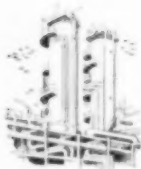
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Where there's heat and H_2S , specify FIBERGLAS* insulation



On those tough jobs around refineries and chemical plants, those places where you pit insulation against heat in a corrosive acid atmosphere, put Fiberglas Thermal Insulations to work. They do a top-efficiency job of keeping the Btu's in their place, and give extra years of service against acid products.

You can get Fiberglas Insulating Material for any kind of job... hot or cold, flat surfaces or irregular shapes. All types are formed from small-diameter strands of glass

in a jack-straw arrangement to give maximum insulating efficiency with minimum weight. And being glass, these insulations cannot rot or be corroded by acids, will not feed flames.

The cost of Fiberglas Insulations is as low as any other comparable insulation, lower than most. Easy to apply by standard methods. Ask your local Fiberglas Sales Office, in 27 leading cities, for a copy of "Fiberglas in Industry", a 12-page technical booklet. Or write to Owens-Corning Fiberglas Corp., Department 950, Toledo 1, Ohio.

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*Compare it
on ANY count*

Industry's new steam drive



Here's the new general-purpose turbine that meets the increasingly rigid demands of modern industry. Wrapped up in one *standard* unit are the best features of previous Westinghouse drives . . . plus important refinements and new developments, including features formerly obtainable only as costly "specials"

The new "Type E" is designed to operate reliably and efficiently where the going is tough. It's built to give trouble-free, economical performance for long periods of continuous operation . . . or instant operation when used as a standby drive . . . regardless of operating conditions.

Weatherproof bearing seals, corrosion-resisting gland zones, centerline support for freedom of expansion and contraction, dual protection against overspeed, floating movement of governing and trip linkages, and parts interchangeability between wheel sizes are among the many advantages built into the new "Type E" drives.

← **GET THE FACTS.** We invite your comparison. For the full story, call your nearby Westinghouse office. Ask for the "Type E" Turbine book B-3896, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-50498-A



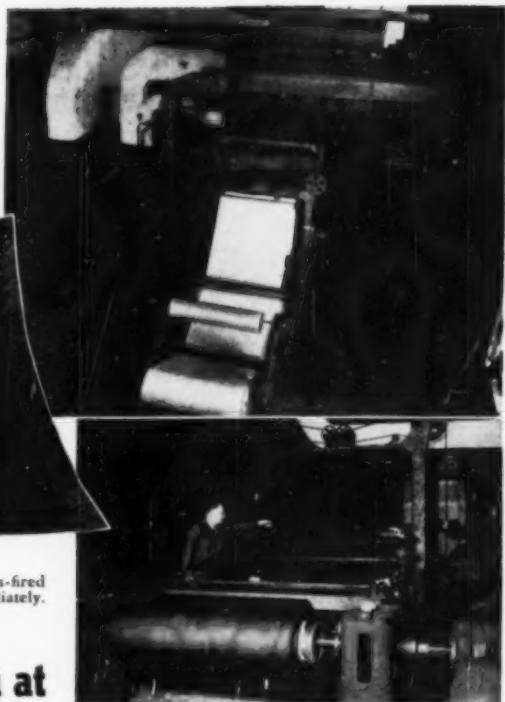
Westinghouse
TYPE E
Turbines



Gas-fired fabric latexing unit from entering end. Cord fabric passes through the dryer after impregnation with rubber or rubber-like material.

CONTINUOUS FABRIC LATEXING

Impregnated fabric leaves the Gas-fired unit dry enough to be spooled immediately.



Production Drying Operation at INLAND RUBBER CORPORATION *Demonstrates Speed of GAS*

LATEX IMPREGNATION is one of the important process applications of heat in which GAS serves so successfully as the high-speed production fuel.

First installation of its type, the continuous latexing system at Inland Rubber Corporation, Chicago, demonstrates efficient utilization of GAS for production-line drying. In this process a water-dispersed material of rubber or rubber-like solids is applied to cotton or rayon tire cord web. The dryer, operating at a speed of 28 yards per minute, reduces moisture content of the impregnated web to less than one per-cent.

Speed-heating with GAS in this modern continuous dryer is an important factor in the tire-cord production line at Inland Rubber Corporation. Executives cite these results—

- Improved adherence of coating to tire-cord
- Minimized non-productive time due to rapid warm-up cycle
- Drying efficiency improved by automatic temperature control
- Reduction in maintenance costs with simplified equipment
- Economies in fuel costs over previous heat-processing medium

Throughout the textile industry GAS serves the myriad heat-processing needs of production-minded executives. Efficient utilization of this flexible fuel as demonstrated at Inland Rubber Corporation, emphasizes the possibilities for maximum return on an investment in modern Gas Equipment for textile processing. They're worth investigating.

Continuous latexing system designed and installed by Industrial Ovens, Inc., Cleveland, engineers and manufacturers of heat processing equipment.

AMERICAN GAS ASSOCIATION
420 LEXINGTON AVENUE • NEW YORK 17, NEW YORK

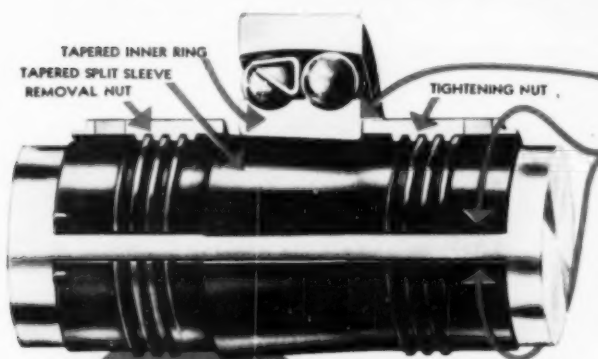


SOMETHING NEW!

SKF introduces the
SUA UNIT PILLOW BLOCK
featuring a tight fit
between bearing and shaft



Here's How It Works



TIGHT FIT results when the tightening nut pushes the tapered inner ring over the tapered split sleeve.

CONCENTRIC GRIP is firm and positive—as the split sleeve contracts and wraps around the shaft. Removal is accomplished by reversing the process—with tightening nut loosened, removal nut pushes inner ring off the sleeve.

ON or OFF
in a few seconds

The new **SKF** SUA Unit Pillow Block is completely assembled, lubricated and ready for immediate use. Available in "free" or "held" types and in shaft sizes from 1 $\frac{1}{8}$ " to 2 $\frac{7}{8}$ ".

Its **SKF**-exclusive Align-O-Seals prevent lubricant leakage and dirt intrusion. Designated as type SUA with ball bearings—and type SUAR with spherical roller bearings.

No exposed bearing . . . no lock screws to raise troublesome burrs on the shaft . . . the nut is locked to the sleeve . . . and even though the shaft vibrates, the concentric grip will not loosen.

For more information, check your local authorized **SKF** Distributor, or write: **SKF** Industries, Inc., Philadelphia 32, Pa.

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Bearings and pillow blocks engineered by



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**Soaring Demand Brings
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**Factors: New Crop of Stores
And Factories; More Home
Appliances; Big Farm Use**

An \$8,500,000,000 Investment

By ROBERT H. SELLITTE

Electrically minded Americans have changed the nation's electricity makers into the biggest power expansion program the world has ever seen.

Unhappily measures of its magnitude:

to U. S. power making facilities

for 1939 are by themselves greater

combined generating capacity of

Great Britain. New capacity

completed in the next three

years as much as has been

discovered.

Outlook: The \$8.5

trillion-making com-

pend on ex-

penditure

program.

spent

over

world

*The Wall Street Journal,
February 21, 1949*

10%

The power generating facilities designed and constructed by Stone & Webster Engineering Corporation through the years total over 6,000,000 kilowatts, equivalent to one-tenth of the total generating capacity of all electrical utilities in the United States.

Work of the Corporation currently in progress for leaders in the industrial and public utilities field in all parts of the country will increase this total over 2,000,000 kilowatts.



STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

A 4TH Size Has Been Added To . . .

HOOKEE ALUMINUM CHLORIDE

In addition to the three popular sizes in which Hooker Aluminum Chloride anhydrous has been available, it is now being supplied in an extra fine grind.

Now you can get this catalyst in the size which is most effective for your particular reaction.

- **EXTRA FINE GRIND**—An unscreened material, 90 to 95% passing 40 mesh.
- **FINE GRIND**—An unscreened material practically all passing 20 mesh.
- **COARSE GRIND**—An unscreened material 1 mesh and finer, containing 25% to 35% finer than 20 mesh.
- **COARSE SCREENED**—Same as coarse grind but screened to remove 20 mesh and finer.

All sizes are of the same high purity—particularly free from iron and other non sublimables—and every shipment conforms to exact Hooker specifications. For smooth reactions—in Friedel Crafts syntheses, polymerization, isomerization and halogenation—select Hooker Aluminum Chloride, Anhydrous.

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HOOKEE ELECTROCHEMICAL COMPANY

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CHEMICAL ENGINEERING—June 1949

HOOKEE RESEARCH PRESENTS

SODIUM TRIFLUOROACETATE



Molecular wt. 136.02

Purity 98%

Hooker Sodium Trifluoroacetate, another in the growing list of Hooker fluoride derivatives, is a white, non-corrosive free flowing powder. It is very soluble in water, soluble in ethanol, methanol and methyl ethyl ketone, slightly soluble in ether and insoluble in benzene, carbon tetrachloride and perchloroethylene. It is resistant to hydrolysis, not being attacked by aqueous alkali at the boiling point. Physical and chemical properties of sodium trifluoroacetate indicate its use as an intermediate in the preparation of herbicides, insecticides and dyestuffs; as a condensing agent. For organic synthesis, sodium trifluoroacetate is generally converted to the acid and enters into many interesting and promising reactions.

Technical Data Sheet No. 377 gives additional physical and chemical characteristics and indicates typical reactions. It is available when requested on your business letterhead.

Research samples in the size you want, and Technical Data Sheet 714 will be sent when requested on your business letterhead.

Specifications:

HOOKEE ALUMINUM CHLORIDE, ANHYDROUS

Appearance: Grayish crystalline solid.

ANALYSIS:

AlCl₃, Min. 98.5%

Fe, Max. 0.05%

Non-sublimables in air at 950°C, Max. . . 1.5%



9-434



**With the Southern Cotton Oil Company, too . . .
It's MONEL for handling H_2SO_4 and fatty acids**

Approximately 60,000 pounds of 0.125" sheet Monel was used to fabricate these 12 self-supporting, fat splitting tanks at the Southern Cotton Oil Company's Savannah, Ga. plant. A similar installation was erected at this company's Gretna, La. plant.

RECENTLY, the Southern Cotton Oil Company erected 24 large self-supporting, fat splitting tanks—12 at their Savannah, Ga. plant, and 12 at their Gretna, La. plant.

Based on its outstanding service record in fat splitting operations, Monel® was chosen.

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Monel are as corrosion-resistant as the alloy itself.

Prominent manufacturers of stearic acid, red oil, glycerine and allied chemicals have reported service records up to eleven years for Monel tanks and heating coils.

For further information about the applications of INCO Nickel Alloys in chemical processing, write for: "Resistance of Inconel, Nickel, Monel, and Ni-Resist to Corrosion by Fatty Acids."

Meanwhile, if you have metal selection problems involving product contamination, heat resistance, or corrosion resistance, why not consult our Technical Service Department?

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

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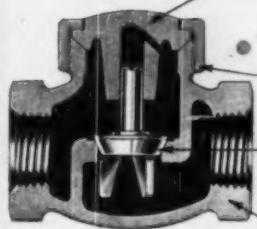
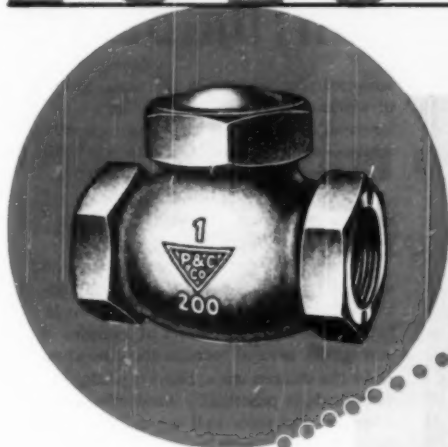
MONEL...for Minimum Maintenance

R.P. & C

BRONZE

LIFT CHECK VALVES

*designed and built
to take **PUNISHMENT***



- 1 **CAP**—forms an efficient beveled joint with the body. The integral disc guide has long contact with the disc stem for perfect alignment and resulting free movement and positive seating. It also cushions disc movement.
- 2 **UNION NUT**—heavy and rugged. Can be removed and replaced without danger of distorting the body or weakening threads.
- 3 **DISC**—well guided with just the right seating angle for positive closure without sticking. Seating surfaces regrindable.
- 4 **BODY**—has heavy section at cap joint and end hex with long contact end threads. Seat is integral with body.

THESE BRONZE LIFT CHECKS—rated 200 pounds and 300 pounds—are especially suited to prevent back-flow on high velocity line or where flow is pulsating. Shut-off is quick, positive and tight. For use in horizontal lines only. • (On low or moderate velocity lines, R-P & C swing checks are recommended.) • Get in touch with the nearest R-P & C District Office or R-P & C Distributor for information about Check Valves.

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AMERICAN CHAIN & CABLE**

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PRATT & CADY
VALVES**

*For
Permanent*

WHITE FINISHES

USE

BARRETT* PHTHALIC ANHYDRIDE



American housewives recognize degrees of whiteness. They demand that white household equipment be a pure gleaming white—without any trace of color—and they expect it to stay that way indefinitely.

Such finishes require products of established purity . . . Barrett phthalic anhydride, for instance.

Barrett phthalic anhydride in the solid state has a pure flat white color with no tints of any primary color. This color is retained indefinitely; tests of samples in storage for several months show no change.

In the molten state, Barrett phthalic anhydride is practically water-white or colorless and tests well within the limit of the standard specification of 55-Hazen established by the industry. In actual tests, it has remained within the limit of 55-Hazen when kept molten for more than 60 hours—a period of time well beyond any normal requirement for processing in plant kettles.

These qualities of Barrett phthalic anhydride make its use especially desirable in better alkyd coatings where whiter finishes and perfect colors are required.

It is shipped in 5-ply paper bags, even net weight 80 lbs., and in light wooden barrels, even net weight 275 lbs.

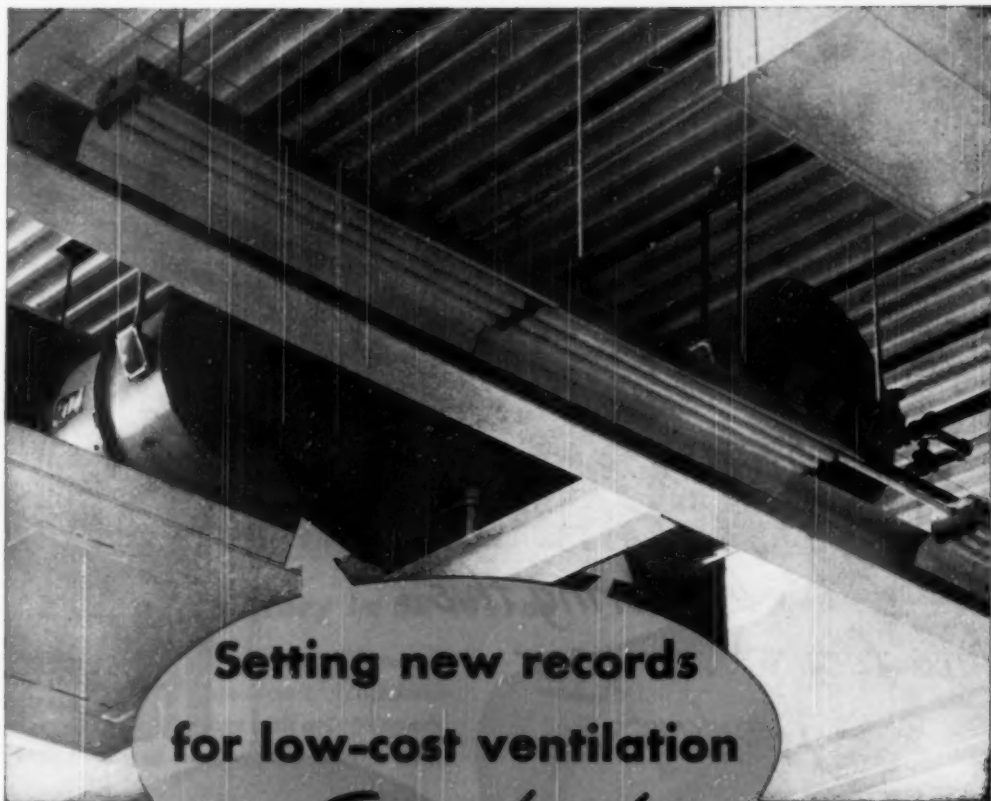
THE BARRETT DIVISION

ALLIED CHEMICAL & DYE CORPORATION
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In Canada: The Barrett Company, Ltd., 5551 St. Hubert Street, Montreal, Que.



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for low-cost ventilation
Everywhere!

JOY AXIVANE* FANS

WITH JOY AXIVANE Fans, you profit by the greater efficiency, quieter and smoother operation, and lower power consumption of their vaneaxial design. You save on installation, too. These light, compact, in-line fans mount directly in the air duct—saving space and time, making

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Engineer*



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into focus... on your
products...*



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Topmill
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Chase Special
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Chase Specialties:
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VALUE, in terms of Chase Bags, means that your products are packed in containers that are backed by more than a century of improvement. Result: you get GOOD LOOKS, POSITIVE PROTECTION, DEPENDABILITY!

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Check on this important subject—your inquiry will receive prompt attention.



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Chase Lined
and Combined
Bags



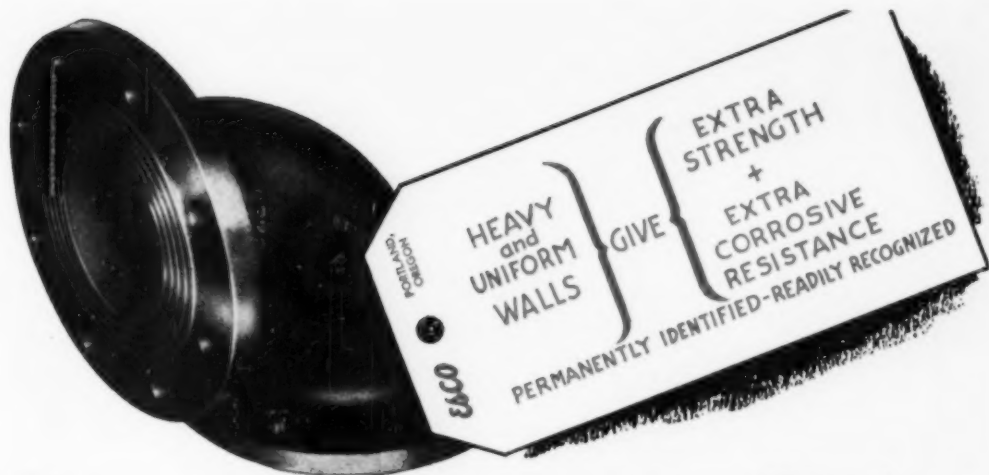
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Directions for Better Piping

A Complete Story in 58 Words

The two-sided tag reproduced here tells the story of ESCO stainless steel corrosion-resisting pipe fittings with only 58 words. For details of sizes and dimensions let us send you our Fittings catalog 165Ar.



STAINLESS and HIGH ALLOY STEELS FOR THE PROCESS INDUSTRIES

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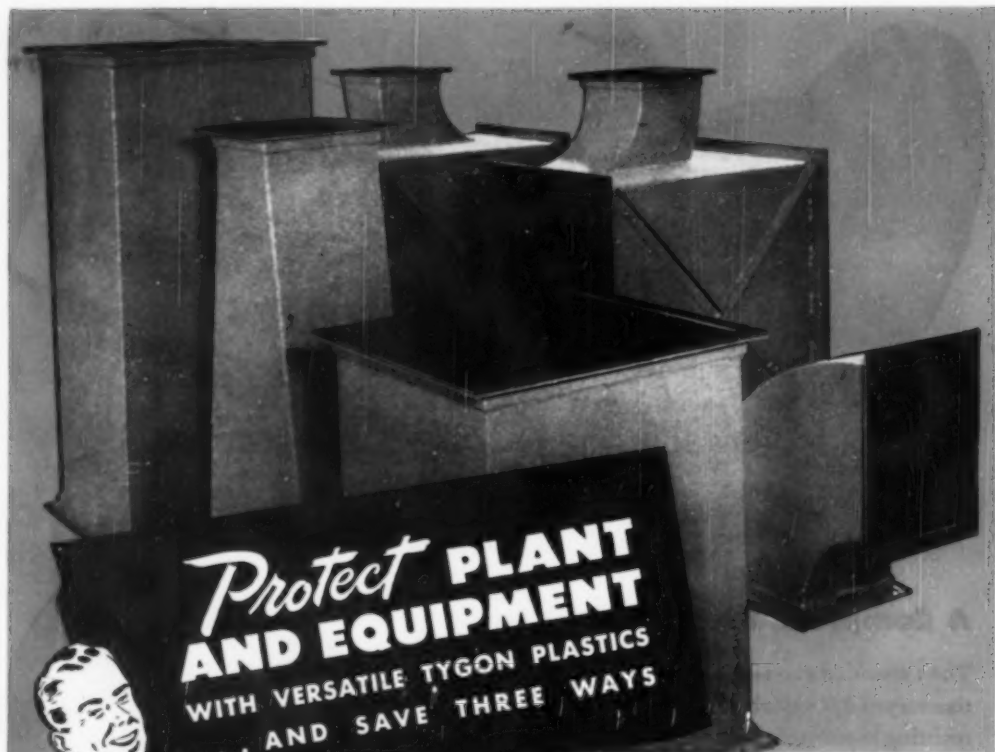
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- 1 LOWER MAINTENANCE COSTS
- 2 LESS PLANT "DOWN-TIME"
- 3 LESS SOLUTION LOSS

When you use versatile Tygon Plastics to protect buildings, tanks, ducts, pipe, valves, pumps and other equipment from corrosive attack, you're not only sure of longer, maintenance-free life, but: 1. You reduce "Down-time" resulting from taking equipment out of production for repairs or replacement, and 2. You avoid product or solution loss from corrosive contamination.

Tygon Plastics are resistant to a wider range of chemicals than any other material of construction, with the exception of glass and chemical stoneware. Yet, Tygon Plastics have a versatility in use approached by no other material.

For example: Tygon sheet linings $\frac{1}{8}$ " thick can be applied to tanks, ducts, pipe and valves from 2" dia. up. Tygon cut or molded gaskets provide pressure tight, corrosion-resistant seals; Tygon molded mechanical goods items can be made to virtually any shape and in a wide range of hardnesses; Tygon flexible

Tubing makes an excellent piping medium for gas, air or liquids, and Tygon extruded strips, tape or special cross-sections solve difficult sealing and insulation problems.

The same basic Tygon sheet stocks, liquefied to form a paint, provide unexcelled protection for tank exteriors, machinery, walls, structural steel, in fact for any surface where corrosive attacks from fumes, condensates or spillage may occur.

Tygon Plastics bring to the corrosion engineer, a versatile, flexible, effective material for saving maintenance dollars. If you're not acquainted with Tygon Plastics, drop us a note, today.

PROCESS EQUIPMENT DIVISION . . .



THE *Chemmentator*

Reg. U. S. Pat. Off.

COMMENTS ON THE NEWS OF CHEMICAL ENGINEERING IN INDUSTRY

June 1949, Volume 56, Number 6

For sale: I. G. Farben

I. G. Farben plants, currently operating as independent units, may soon be sold. U. S. Military Government is now completing plans for their sale. Anyone cleared by occupation authorities may get a crack at buying the Farben plants. But the German trustees now running them are odds-on favorites to become the owners.

Seizure of I. G. Farben came almost as soon as military occupation authorities took over. Shortly afterward, separate German trustees were assigned to manage each of the 30 individual producing concerns.

Breakup of the vast Farben edifice has been a prime objective of the occupying powers. In its report on German decartelization, the Ferguson Committee makes this point: the only two monopolies that the U. S. Military Government has successfully smashed are the German banking interests and the I. G. Farben cartel. And despite shortages of raw materials, the committee adds, production in I. G. plants today is higher than it was before decartelization.

Sale of these plants to the German trustees who are running them would be made possible by the plan now being drafted.

Similar plans are being worked out by the French and British in their sectors of Germany. But what the Russians are doing in their zone is not divulged.

Wanted: a Newton of the social sciences

Great discoverers and great discoveries of tomorrow may be in the field of sociology, biology and psychology and not in the physical sciences, thinks Monroe E. Spaght, president of Shell Development Co. We know enough in the technical field to solve the problem of supplying all humans with their reasonable physical needs, he believes, but the psychological blocks in the human mind are the preventives to peace. Spaght envisions tomorrow's geniuses working to remove these psychological blocks. And he feels that the discoveries may not be brought about through "the familiar scientific method of measurement and experiment."

An age of "moral adulthood" and peace for the world may be the direct result of the next great discoveries in man's history.

"The world has an increasing awareness of sociology," Spaght points out. "All of us, the world over,

would rather have no war than to have a new mechanical comfort. Yet, our success today is primarily in the direction of supplying man with improved mechanical devices, and not meeting the desire for peace. However, we, as humans, note the need, we see it as obvious, and the geniuses of tomorrow will be the scientists who, by unlocking the great unknown in human behavior and thought, make it possible for us to advance in the correct sociological direction.

"The next great age of scientific discovery probably will be in the biological field and the greatly increasing experimentation in sociology portends good for mankind."

Export of know-how: As an example of sociological experiments, Spaght cites the Marshall Plan and says, "We must give away our technological know-how to countries that do not have it." He feels that such action on the part of nations and of industrial concerns is a sign of "moral adulthood."

"The rockets' red glare . . ."

Rocket fuels are getting top-priority attention of Army Ordnance researchers. Contract just signed by Army Ordnance with Mathieson Chemical Corp. calls for production of anhydrous hydrazine. Whole project is hush-hush. Ordnance is not saying how much of the Mathieson hydrazine is going into rocket fuel or even whether its use is out of the experimental stage.

Hydrazine, however, has all the characteristics of a good rocket fuel. Its boiling and freezing points are near those of water. When combined with liquid oxygen, nitric acid or hydrogen peroxide, it yields exhaust products of very low molecular weight and extremely high temperature. One of the most used oxidizers is nitric acid.

Odds are that Army Ordnance is already putting hydrazine to work as a propellant fuel for rockets.

Du Pont: a whopper on the hook

Anti-trust case against Du Pont is still before a grand jury in Chicago. The anti-trusters want to divorce Du Pont of any control whatsoever over General Motors. They charge that Du Pont's control of GM, now exercised through the GM stock Du Pont owns, has been used to get GM business for Du Pont.

(Continued on page 70)

How Mohawk Carpet Mills

CUTS COSTS, INCREASES PRODUCTION

...by using
General Electric
Spectrophotometer
to help solve
color problems



Technician Donald Johnson makes a test with Mohawk's General Electric spectrophotometer.

You, like Mohawk's J. J. Hanlon, may be able to cut costs by using a G-E spectrophotometer to set up color standards and to control color of dyes and of textiles in production. Or use the spectrophotometer in your plant for controlling color of paints, glass, inks, and paper, or in your laboratory for chemical, pharmaceutical, and medical analysis.

CUTTING COSTS

Assistant superintendent of dyeing, Mr. Hanlon learned that dyeing costs were high on one of Mohawk's popular broadloom carpets. Several differ-

ent dyes were used in preparing the color. Difficulty in matching the color sometimes caused costly delays in processing the batch. Then Hanlon went to work with the G-E spectrophotometer, used for more than six years in helping to solve Mohawk's color problems.

"Color analysis on this problem," says Hanlon, "showed how to match the standard with just two dyes instead of several. Now we match the standard more quickly than before, and have *doubled* the amount of wool dyed at one time. And by eliminating the delays we ran into when using several dyes for the color, we have a more efficient operation."

A G-E Instrument for Your Problem

Your problem may even justify developing a new instrument, particularly if the problem is a common one. Write today to Apparatus Dept., Section 687-2, General Electric Company, Schenectady 5, N. Y.

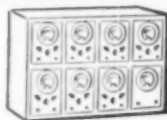
General Electric testing and
measuring equipments for
nearly every industrial process



Coil Testing



Time, Speed and Torque



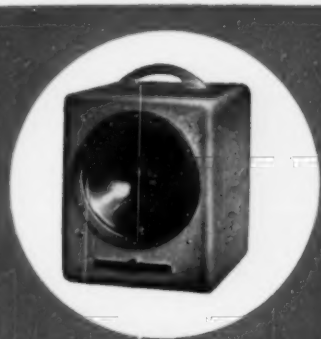
Force, Strain and
Thickness Gages

To Develop Improved High-speed Machinery ... study breakage or motion with aid of G-E Photolight

By enabling the camera to photograph high-speed mechanical motion, the photolight provides a quick, easy, and accurate means of studying problems of breakage or motion in both large and small high-speed machines.

For example, with the aid of the photolight scientists have developed better circuit breakers and relays, projectiles, turbine rotors, shotgun shells, and many other equipments operating at high velocity.

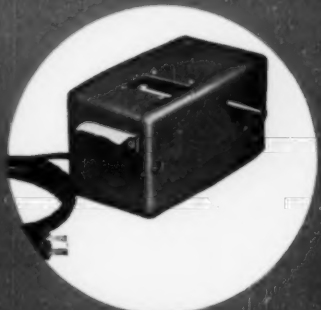
The new G-E photolight provides a high-intensity flash of blue-white light with a duration of two microseconds or less for use in open-flash photography. Objects have been photographed moving as fast as 2700 feet per second. Write for GEC-337.



To Increase Life of Equipment... check for excessive vibration with General Electric's recording vibrometer

You can safeguard the life of high-speed machinery such as steel mill rolls or printing presses by using the G-E recording vibrometer to measure excessive vibration in bearings, shafts, and gear trains, or to test motors, compressors, fans, blowers, and pumps. The instrument records on waxed paper both the amplitude and frequency of vibration.

These are a few of the applications where the recording vibrometer will cut your design and maintenance costs. Write for GEC-310. For data on other vibration measuring equipments, ask for GEC-4140.



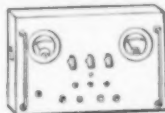
To Measure Rotational and Linear Speeds... use the G-E Hand Tachometer for accurate readings

You can easily and accurately check for motors that are running over- or underspeed with the aid of the G-E hand tachometer. You can also use it to measure cutting speeds of lathes and milling machines, and linear speeds of planer beds, shapers, band saws, and conveyor belts.

Built with a two-foot electric cable for reaching into out-of-the-way places, the hand tachometer has an accuracy of plus or minus 1%, and the head is not affected by machine vibrations or temperature changes. You can adjust the speed-range with a flick of the thumb, without removing the spindle from the rotating shaft. Write for GEC-241.



Materials Testing



Chemical Analysis



Insulation Tester



Leak Detector



Vibration and Sound

GENERAL ELECTRIC

THE CHEMENTATOR, continued

business that might otherwise have gone to Du Pont's competitors.

Evidence they have, the anti-trusters are confident, is strong enough (1) to get an indictment from the grand jury and (2) to win either a negotiated consent decree or a court decision. They know they have a whopper on the hook. But they think they can dissipate the Du Pont holdings in GM.

Disposition: Parceling out of Du Pont's GM stock to Du Pont shareholders will not satisfy the anti-trusters. Instead, they will recommend a voting trustee to redistribute—under court supervision—the GM stock so that separate voting control of the two companies would be assured upon the termination of the trust. This reshuffling job could take five years or longer. And the GM stock is not going to be suddenly dumped on the market.

Nitric acid from the atmosphere

Nitrogen fixation that leads directly to nitric acid is the goal of work in the San Jose, Calif., pilot plant of Food Machinery & Chemical Corp. This summer, if there are no hitches, the pilot plant, in which almost \$700,000 has been invested, should be producing about 1,000 lb. of nitric acid an hour.

Process works like this: (1) air is preheated; (2) part of this air is burned with gas, reaches a temperature close to 4,000 deg. F.; (3) at that temperature nitrogen and oxygen in the air react directly to form nitric oxide (concentration: about 3 percent); (4) hot gas is quenched to prevent decomposition of the oxide; (5) cooled gas passes over a bed of silica gel (gel adsorbs nitric oxide; moreover, it catalyzes oxidation of nitric oxide to nitrogen dioxide, the acid anhydride); (6) small quantity of hot gas then desorbs the nitrogen dioxide; and finally (7) the gas stream, rich in nitrogen dioxide, is absorbed in water to form nitric acid.

Furnace operates recuperatively. It is a horizontal pebble-bed furnace with two connecting chambers. Refractory linings and the 1½-in. pebbles are magnesia. Chambers are about 12 ft. long, with inside diameters of about 12 in. Besides the refractory lining, each chamber has thermal insulation. All told, there is about 2 ft. of insulation to avoid high heat loss. The outside wall temperature is approximately 300 deg. F.

Refractory used in the present furnace is magnesia. But at temperatures near 4,000 deg. F. magnesia volatilizes and both lining and pebbles spall. Food Machinery, however, has an ace up its sleeve: stabilized zirconia. When the bugs are worked out, a furnace with stabilized zirconia lining and pebbles might reach temperatures close to 4,500 deg. F. At 4,000 deg. F. efficiency is about 75 percent; at 4,200 deg. F. it is almost 85 percent. At least four makers of refractories have worked with Food Machinery,

some on magnesia and others on stabilized zirconia.

Patent snarl on this nitric acid process has now been untangled. Wisconsin Alumni Research Foundation patented the original process. When Food Machinery acquired the process from Wisconsin, it got both patents and rights on those unissued. Meantime, Robert D. Pike had been doing research on a similar process for Westvaco, to whom he exclusively assigned his patents. Pike and Wisconsin applied for patents that interfered with each other. When Food Machinery purchased Westvaco, however, this interference was resolved. In fact, the scuttle butt is that this was one reason why Food Machinery bought Westvaco.

Commercialization, at least two years off, could make the wedding of Westvaco and Food Machinery most fruitful. With its electric furnaces at Pocatello, Idaho, Westvaco is a power in phosphates. And Westvaco holds vast trona deposits in Wyoming. Why not, then, build Food Machinery nitric acid plants at Westvaco's trona deposits and make nitrate fertilizers on the spot? The process requires about 80-100 million Btu. per ton of nitrogen. But there is plenty of natural gas nearby for the regenerative furnaces, which require little cooling water, so the whole idea is a natural. Only an adverse decision on basing points or a major depression could stop this development—if the nitric acid process proves economical. All important in making the process pay will be the right refractory.

Implications of this nitric acid process for the future are exciting. The process fixes nitrogen thermally instead of catalytically; it goes directly to nitric acid, bypassing the oxidation of ammonia. About 20 percent of the ammonia produced in this country is oxidized to nitric acid.)

Unlike the Haber process, with which it would compete, the process requires neither purification of nitrogen and hydrogen nor special high-pressure equipment. It would have great impact on the manufacture of ammonia, nitric acid and nitrates for fertilizers and explosives. In time of war, the process might become an important alternate method of getting fixed nitrogen, vital for the liquid fuels that power guided missiles and rockets.

Pioneering work on refractories for the Food Machinery furnace opens vistas of future high-temperature chemistry. But first entirely new refractories and almost instantaneous quenching techniques to freeze equilibria will have to be found. The work at San Jose is a bold first step toward the high-temperature chemistry of tomorrow.

Phosphates spell boom for Pocatello

Boom town is Pocatello, Idaho, where the population is up 38 percent although the whole state has chalked up no significant gain since 1940. Boom is

(Continued on page 72)

COLUMBIA CHEMICALS

SODA ASH
CHLORINE
CAUSTIC SODA
SODIUM BICARBONATE
CALCIUM CHLORIDE
CAUSTIC ASH
MODIFIED SODAS
SODA BRIQUETTES
(Iron Desulphuriser)
PHOSFLAKE
(Bottle Washer)
SILENE EF
(Hydrated Calcium Silicate)
CALCENE T
(Precipitated Calcium Carbonate)
PITTCOLOR
(High Test Calcium Hypochlorite)
PITTCIDE
(Special Calcium Hypochlorite)
BORAX
PACIFIC CRYSTALS
(Sodium Sesquicarbonate)

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FROM THAT OF YOUR MANAGEMENT—

Columbia policies foster profitable business relationships.



FROM THAT OF YOUR TECHNICAL STAFF—

Columbia manufacturing controls eliminate production difficulties arising out of variances in quality and grading.



FROM THAT OF YOUR PURCHASING DEPARTMENT—

Columbia plant locations and expeditious handling of your inquiries and orders assure fast service.

Yes, from any viewpoint, Columbia offers definite advantages as your source of supply for alkalis, chlorine and related chemical specialties. Pittsburgh Plate Glass Company, Columbia Chemical Division, Fifth at Bellefield, Pittsburgh 13, Pa.



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PAINT • GLASS • CHEMICALS • BRUSHES • PLASTICS

PITTSBURGH PLATE GLASS COMPANY

THE CHEMENTATOR, continued

built on production of phosphate fertilizers to feed the hungry soils of U. S. farms.

Man behind the boom is Boise promoter J. R. Simplot. He made a quick fortune dehydrating potatoes for the armed forces, then staked a claim in the phosphate fertilizer business at Pocatello. Not too many years ago, Jack Simplot was earning his wages at the endless belt of a potato-sorting machine.

Phosphate fertilizer output of Simplot's company was originally 50,000 tons a year. Now it is up to 220,000 tons. Westvaco and Simplot Fertilizer Co. work the same deposits of phosphate rock. Not satisfied with making phosphate fertilizers, Simplot is now opening his ammonium sulphate plant in Salt Lake City. And he plans to make ammonium phosphates soon.

Electric power is gobbled up in fertilizer production. So the U. S. Bureau of Reclamation plans to build on the Snake River, in mile-deep Hell's Canyon, a dam to be the highest in the world.

Outlook is even brighter. Jack Simplot is so enthusiastic about prospects that he reportedly has turned down \$5 million for his fertilizer holdings. And the government is going to build a \$500 million atomic testing station in the desert northwest of booming Pocatello.

Job and salary outlook for engineers

How many engineering graduates will get jobs this year? Not as many as last year, according to 1949 employment programs of 155 industrial companies and 27 governmental agencies just surveyed by the Engineers' Joint Council. Preliminary tabulation of the survey results is significant, for these 155 companies and 27 agencies together employ almost 76,000 engineering graduates or over one-quarter of some 265,000 graduate engineers in the U. S.

Jobs: These organizations estimate they will hire 7,560 inexperienced engineering graduates in 1949. That is 23 percent less than the 9,500 they took on in 1948. For the industrial companies, the decrease is 26 percent to a total of 5,440; for the governmental agencies, the dip is 8 percent to a total of 2,120. Agencies of state governments, however, expect a substantial increase. The estimated over-all employment includes 993 chemical and ceramic engineers.

Salaries: Chemical and ceramic engineers get higher starting salaries than other engineers. For all engineers, median starting salaries are \$260 for bachelors, \$300 for masters and \$375 for doctors. But chemical and ceramic engineers do better. Their median starting rates are \$290 for bachelors, \$315 for masters and \$400 for doctors. For all engineers, median monthly increase by the end of the first year is \$30; for chemical and ceramic engineers, it is \$25.

What salaries are men who got their bachelor's

degree 10 years ago earning? For 1,511 graduates out 10 years in 1946, the median monthly salary was \$375. For 1,431 who were out 10 years in 1948, it was \$450, or 20 percent more. Median salary of chemical and ceramic engineers out 10 years is \$520 a month.

Minimum wages going up

Industry by industry, Labor Secretary Tobin is raising minimum wages which must be paid by manufacturers holding government contracts of \$10,000 or more. He is doing it under the Walsh-Healey Public Contracts Act. Under the act, government contractors must pay not less than "the prevailing minimum wage" which the Secretary finds the same or similar industries in the same locality paying.

Soap and glycerine manufacturing will be the first of the chemical process industries to have its minimum wage boosted. Ten years ago, its present minimum of 40 c. was set. Last August, however, U. S. soap workers were averaging \$1.51 an hour, according to a BLS survey. This, the government says, "shows clearly that the 40 c. rate now in effect no longer reflects the prevailing minimum wages in the industry." So a recent Washington hearing considered a raise in the soap industry's minimum.

What minimum will Tobin set? The soapers would like to know. He raised textiles from 40 c. to 87 c.; uniforms from 60 c. to 85 c. He set a rate of \$1.05 in woolen and worsted mills.

Chemicals could be next. Exploratory meetings with management and unions have already aired a raise in the minimum wage to be paid by manufacturers of chemicals and related products. Present rate, set in 1942, is 40 c. Hearings have not yet been scheduled.

Here are some of the minimums: drugs, medicinals and toiletries, 40 c.; fertilizers, 40 c. (50 c. in 11 western states); tanning, currying and finishing leather, 50 c. (40 c. in 14 southern states); manufacture of welting and power transmission belting, 40 c.; paint and varnish, 50 c. (40 c. in 10 southern states); pulp and paper, 40 c. (50 c. on the Pacific Coast).

District 50 vs. CIO at Belle

Donnybrook is due this month at Du Pont's Belle, W. Va., works. For the CIO is seeking another collective bargaining election there. And UMW's District 50, which cannot get on the NLRB ballot because its officers have refused to sign non-Communist affidavits, will not stand idly by.

District 50 had the contract at Belle until an NLRB election was held there last year. District 50 could not get on the ballot, so it urged its members to vote "no union."

CIO lost that election by only 69 votes.

Then District 50 tried to convince Du Pont that
(Continued on page 74)



As the white outline indicates, a standard unit of much greater frame size would be required to do the work of Speedaire. Photo by courtesy of Telling Bello Vernon Division of National Dairy Products Corp.

SPEEDAIRE saves money, speeds work

OPERATING outdoors, with no protection from rain and snow, this Speedaire unit has run steadily for 18 months without any maintenance whatever. It replaced another type of drive on which upkeep was very high and down time excessive. It also saved the company 15.9% of the cost of a conventional worm gear drive. It is one of 7 Speedaire units driving conveyors at a dairy products plant.

Speedaire is Cleveland's new fan-cooled worm-gear speed reducer. Because it is fan-cooled, Speedaire will do more work—will deliver up to *double the horsepower* of standard worm units of equal frame size, at usual motor speeds. It can be installed economically on many applications where other types have been used heretofore—giving you the advantage of a compact right-angle drive. Speedaire gives the same long, trouble-free service characteristic of all Clevelands.

For full description, send for Catalog 300. The Cleveland Worm & Gear Co., 3273 East 80th St., Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited



CLEVELAND
Worm Gear
Speed Reducers

THE CHEMENTATOR, continued

its "no union" majority was actually a mandate from the workers to keep District 50 as bargaining agent. When this failed, violence flared at Belle in June a year ago as District 50 struck to force the management to recognize it.

Officers of both AFL and CIO chemical unions have signed the affidavits required by the Taft-Hartley Act. Both unions are making good use of their advantage over District 50.

Incidentally, if the Taft-Hartley Act is overhauled this year, which may not happen, not only labor leaders but management executives will have to sign non-Communist affidavits to avail themselves of NLRB's machinery.

Can your plant top this mark?

World's safety record has been set by Du Pont. Its nylon plant at Martinsville, Va., operated for 82 months without a lost-time injury. Achievement is the best no-injury record known to the National Safety Council.

Of soap and synthetics

Lever Bros. plans to build a soap and synthetic detergents plant in Los Angeles. Its cost is no soap bubble: it could go to \$20 million.

Detergent called Surf is among the products to be made in the new plant. It is an alkyl aryl sulfonate that also contains phosphates.

Pacific Soap Co., meantime, has gotten a contract from Lever Bros. to make Surf in its San Diego plant, at least until Lever brings in its Los Angeles operation.

Other urea producers?

How much of a boost in urea output can the market absorb? Stabilized now, demand for urea plastics is not expected suddenly to skyrocket. And there are other better fertilizers that are cheaper than urea. Still, talk of new urea producers persists.

Du Pont is sole present producer of urea. Selling its urea at such a low price, Du Pont saturates the market, makes others hesitate to compete. Not long ago, however, Du Pont inched urea up $1\frac{1}{2}$ c. to $4\frac{1}{2}$ c. a lb. Du Pont holds patents on its process. But there are more ways than one to make urea. So the patent situation has not deterred would-be competitors.

Allied is the Johnny-come-lately in the urea business. Its Solvay Process Division is spending nearly \$3 million to put up a urea plant at South Point, Ohio. By year's end, this Ohio plant will be turning out 170 tons a day.

Erection of the Solvay plant presages entry of Allied's Barrett Division into urea plastics. But Allied is unlikely to challenge supremacy of Plaskon and American Cyanamid in molding powders.

Others have toyed with the idea of making urea. Among these companies are: American Cyanamid, big producer of urea resins and molding powders, and such fertilizer makers as Lion Oil, Spencer Chemical and the farmer-organized Mississippi Chemical Corp.

Foster Wheeler is designing a Pechiney process urea plant. Hydrocarbon Research is ready to build a urea plant, but has had only nibbles. Chemical Construction Co. has plans for a urea plant on the board and a possible foreign client on the hook.

Plastics with a Texas brand

Plastics plant near Cuero, Tex., will soon be fabricating polyethylene products. Last few electric power problems are all that hold up full operation. Polyethylene is to come from Du Pont's Orange, Tex., plant.

Enterprise is headed up by Earl Tupper. Plant will be owned and operated by Tupper-Texas, Inc., wholly owned subsidiary of Tupper Corp. Polyethylene plastics are now made by Tupper Corp. in its Farnumville, Mass., plant.

Extruding equipment to turn out film from $1\frac{1}{2}$ mils up is all that has been installed so far. Molding equipment may go in later. Outstanding product to date: a strip of polyethylene $\frac{9}{16}$ in. wide, called modestly by Texans "the widest in the world yet made."

Employment could go to 400, if the plant expands as anticipated.

Buildings and land were purchased by Tupper-Texas from the city of Cuero. In turn, the city bought them from the federal government.

Arkansas traveler

Tennessee Eastman plans to build a new plant. A firm decision on the plant site is due shortly. Right now, Camden, Ark., where Tennessee Eastman has renewed for six months its option on a site, seems like the best bet. To cost an estimated \$5 million to \$10 million, the plant will be up in about a year. It will turn out chemical raw materials for Tennessee Eastman's Kingsport, Tenn., organics plant.

Biggest centrifugal compressor

Largest single-shaft compressor ever built combines three compressor cases into one unit. It will handle six different gases in the Brownsville, Tex., plant that Carthage Hydrocol is putting up to make gasoline from natural gas.

World's biggest installation of centrifugal compressors—24 units with 80,000 installed horsepower—are going into the Carthage Hydrocol plant. Installation is the work of Clark Bros., one of the Dresser Industries group.

Two main compressors in the set up will put out 110,000 cfm. at 100 psi, with a power requirement of 23,000 hp. They are driven by a steam turbine.

End

NATIONAL'S ANSWER...

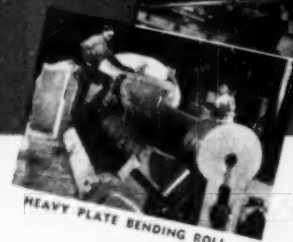
To the World's Petroleum Needs



FRACTIONATING COLUMN



REFINERY COLUMN



HEAVY PLATE BENDING ROLL

Since the company was established in 1926, National Tank has devoted its services exclusively to the production end of the oil industry. National Tank Company is now in a position, through their greatly increased modern facilities, to serve the industry in a much broader way. The new facilities will now permit the manufacture of much larger and higher working pressure vessels for gasoline extraction, refining, gas processing, chemical processing and other lines, in addition to all their present products.

Engineering and design is an important part of the services offered. Experienced engineers and draftsmen, as well as shop and fabricating personnel, are available, with modern facilities to carry out such programs.

SPECIAL EQUIPMENT HAS BEEN INSTALLED TO INSURE QUICK DELIVERY OF ALL VESSELS:

- THREE 5-TON FLOOR CRANES
- FOUR 5-TON CAB TRAVELING CRANES
- SIX 10-TON CAB TRAVELING CRANES
- TWO 50-TON CAB TRAVELING CRANES
- 400-TON HYDRAULIC PRESS

- 10' x 16' HEAD AND PLATE FURNACE
- 7' x 7' x 40' ANNEALING FURNACE
- 15' x 15' x 80' ANNEALING FURNACE
- 2½" CAPACITY PLATE BENDING ROLL
- X-RAY EQUIPMENT FOR PLATE UP TO 20" THICK

The new plant, of more than 5 acres under one roof, is across the street from the present National Tank manufacturing site. Inquiries for quick delivery are invited.

for a National

A color brochure has been prepared describing in detail this new plant, which is located on a 35½-acre site. For your copy, please write

NATIONAL TANK COMPANY

TULSA, OKLAHOMA.

**SMOOTH OR
CORRUGATED**



Dull Grip Finish

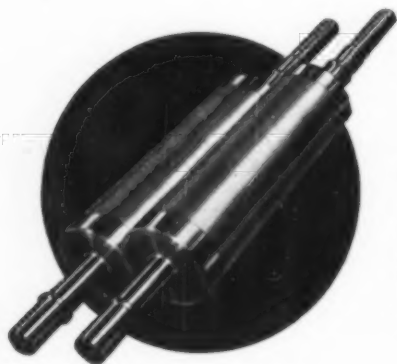


Corrugated Finish



Announcing New

Circle Chill Rolls



Send for New
Circle-Chill
Bulletin 0687218

AFTER THREE YEARS of development and test work in cooperation with a leading foundry, Allis-Chalmers announces the new Circle-Chill roll for the grain and chemical industries.

Centrifugally cast, this new roll is produced by a recently developed casting technique. An outer shell of clear chilled white iron is metallurgically bonded by centrifugal force and temperature to a core of softer gray iron. Centrifugal casting makes possible close control of chill depth and hardness.

Circle-Chill rolls provide a clearly defined and uniform chill depth . . . greater toughness . . . long life. They may be obtained with either smooth or corrugated finish.

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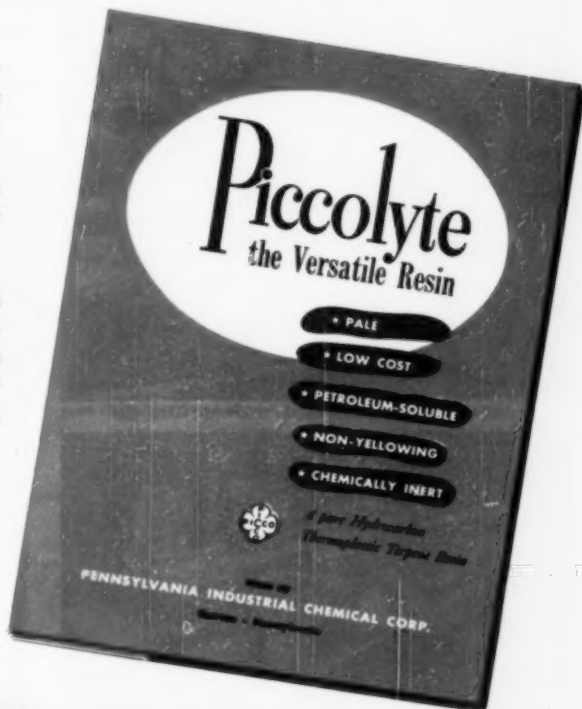
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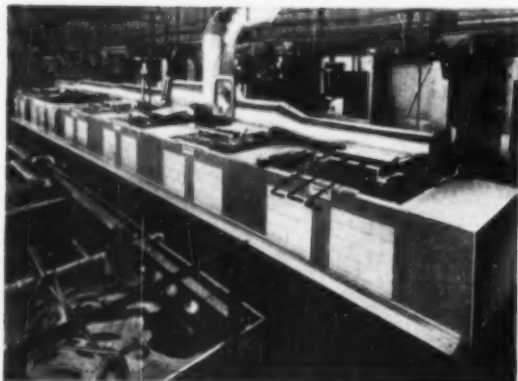
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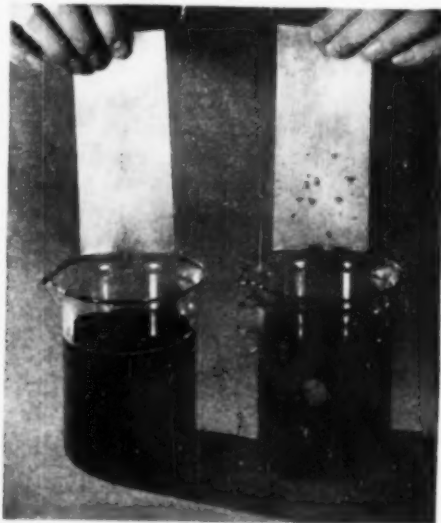
Courtesy Upson Electric Furnace Co.

▲ **CYANAMID'S LOW COST AEROCASE®** Case-Hardening Compounds are the only case hardeners presently being used in ceramic pots (see above photo). They assure longer pot life. These compounds are equally efficient in steel pots. They can be used for neutral hardening; and metals can be quenched directly from AEROCASE compounds into low temperature nitrate baths for isothermal treatment.

◆ **WET-STRENGTH PAPER** plays a vital role in many commercial outgoing lunch operations such as the one shown at the left.

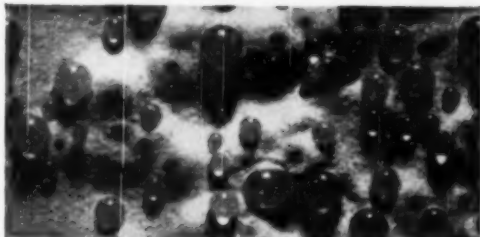
Cyanamid's PAREZ® Resin 607 imparts dependable wet strength to literally hundreds of different types of paper, giving them a sturdiness and versatility usually found in much more costly materials. That's why toweling, blueprint stock, laundry tags, tea bags, frozen food wraps and countless varieties of pre-packaged food wraps are now being made of paper treated with PAREZ Resin 607. Crate and barrel liners, cartridge papers, decalcomanias, filter and glassine papers, saturating papers, maps, labels and innersole board—these illustrate just a few more of the many different uses for wet-strength papers in a wide variety of fields.

Paper manufacturers and converters have found PAREZ Resin 607 an important development because it enables them to reach ever-broadening markets with their wet-strength paper products.

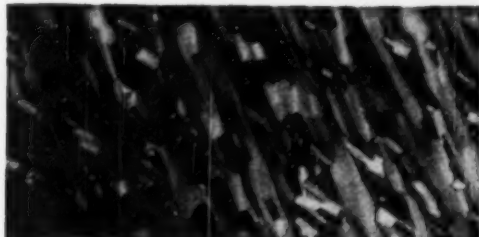


▲ **METAL PARTS** are rinsed in solution of Cyanamid's AEROSOL® OT Wetting Agent (beaker, left) to reduce spotting ordinarily caused by hard water (beaker, right). Cyanamid wetting agents are specially developed to accelerate and facilitate many chemical processes involving the use of water, oils and surface coatings. They increase spreading action, aid penetration, improve contact and thus aid adhesion, regulate characteristics of precipitates, and increase the reaction rates between immiscible liquids. *Reg. U. S. Pat. Off.

Chemical Newsfront



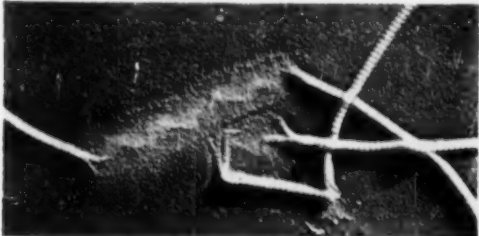
▲ **ARTIFICIALLY** weathered traffic paint, showing reflectant glass beads still firmly imbedded in paint. A photomicrograph at 50X.



▲ **75% AQUEOUS SOLUTION** of AEROSOL OT Wetting Agent, an oil-like liquid composed chiefly of fluid crystals. A photomicrograph at 500X.



▲ **POLISHED SURFACE** of an ore, showing dilution of valuable ilmenite with hematite. A photomicrograph at 260X.



▲ **COLLOGEN FIBERS** from cowhide after partial disintegration in warm water. An electron micrograph at 56,000X.

Reproduced here are three photomicrographs and one electron micrograph included in a series submitted by Cyanamid's Stamford Research Laboratories in a contest held by the American Society for Testing Materials. Eleven of a possible twenty awards were won by Cyanamid.

These photomicrographs are symbolic of Cyanamid's activities in mining chemicals, pigments and resins for paints, AEROSOL® Wetting Agents and leather chemicals.

WRITE FOR LITERATURE. If you would like further information on products mentioned, check off below and mail.

- ☐ PAREZ Resin 607
☐ AEROCASE Case-Hardening Compounds
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☐ Products and Services of American Cyanamid Company for Industry and Agriculture

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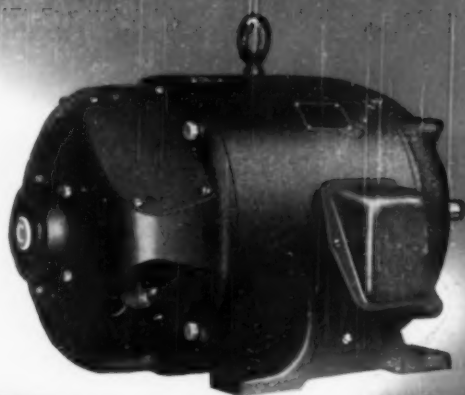
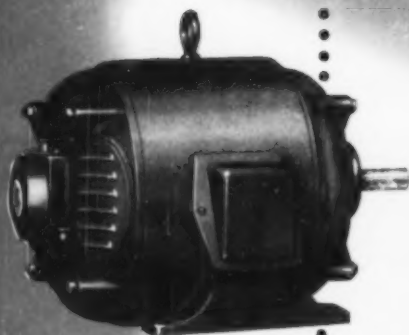
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**.. Use *Century* Type RS
Single Phase Brush Lifting Motors**

Century Type RS, repulsion start, induction, single phase brush lifting motors are ideal for installation on reciprocating pumps, compressors and other hard-to-start equipment.

They provide the power to start under load—even in very cold weather—without overmotoring the driven machine.

Repulsion start motors provide greater starting torque per ampere of current than any other type of single phase motor—consequently the least disturbance to line voltage—an advantage on long or small capacity transmission lines.

They are widely used in the rural areas which usually have only single phase energy.

Many power companies are recommending the use of single phase motors up to $7\frac{1}{2}$ HP, in residential districts of the larger cities, because polyphase energy is not always available.

Century Type RS brush lifting motors are built in sizes from $\frac{1}{2}$ to 20 HP.

Century builds a wide range of types of motors from $\frac{1}{6}$ to 400 horsepower for all the popular electric power applications.

Specify Century motors for all your electric power requirements.

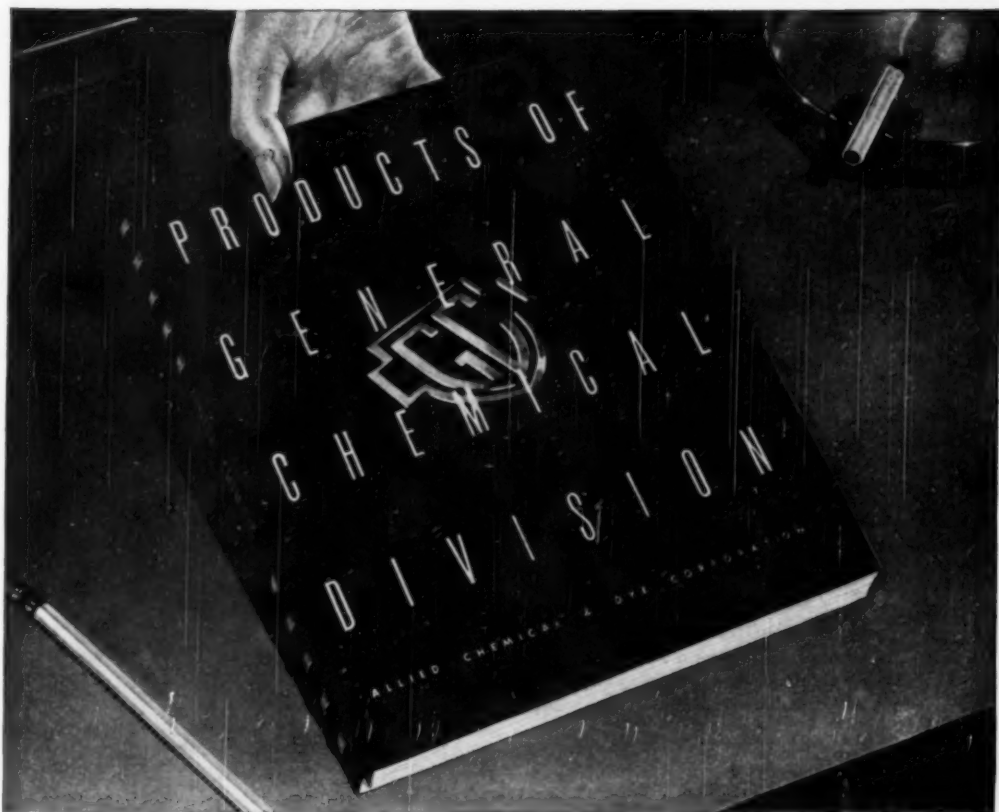
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ganic chemicals for industry and agriculture as well as its broad and varied line of fine chemicals for process use.

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3000 feet of concrete-lined 12-inch steel pipe above ground and 14,000 feet of 12-inch transite underground carry 800 gpm of brine from Lake Searles to the plant.

Another Chemical Plant

This modern soda-ash plant, complete from pipeline to packer, was designed and built by Fluor for the American Potash & Chemical Corporation, as a supplement to their Trona, California works.

Death Valley heat and drouth complicated—but could not prevent—efficient and competent handling of this construction job by Fluor engineers.

A desert, swamp, or snow-swept highland is often the only economic location for a chemical, petroleum, or power plant. In 50 years of designing and building for worldwide industry, Fluor has grown expert in efficient procedure under any adverse conditions.

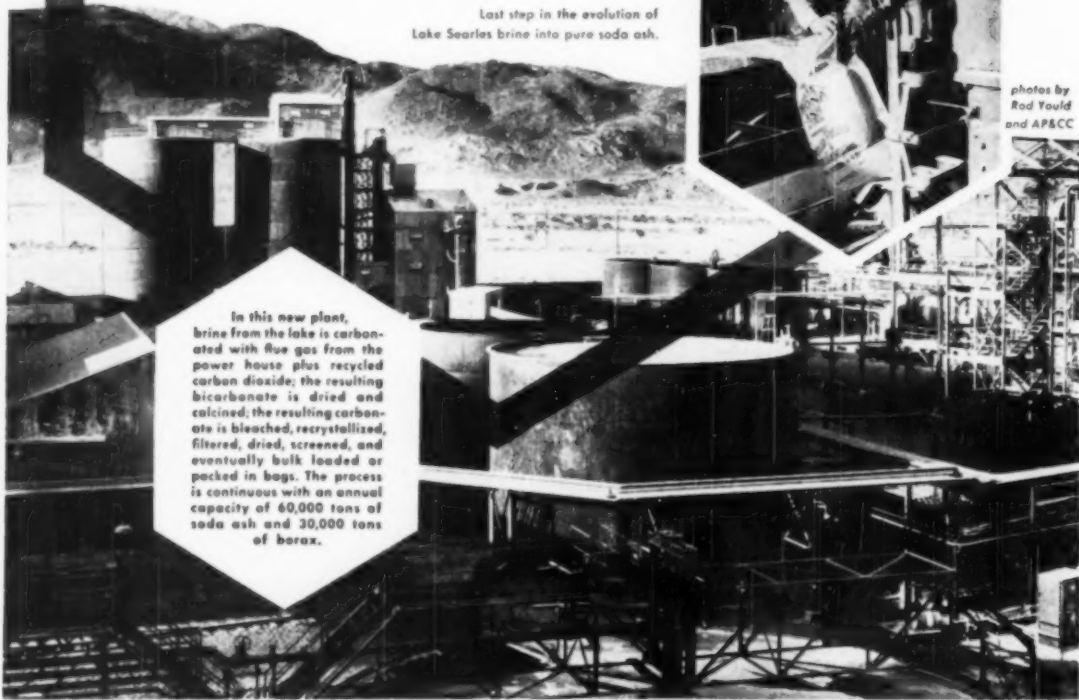
Last step in the evolution of Lake Searles brine into pure soda ash.

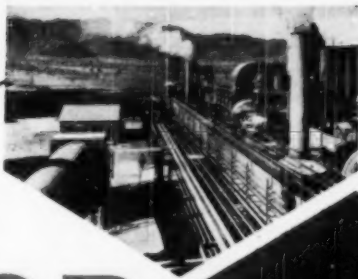
well-built



photos by
Rod Yould
and AP&CC

In this new plant, brine from the lake is carbonated with flue gas from the power house plus recycled carbon dioxide; the resulting bicarbonate is dried and calcined; the resulting carbonate is bleached, recrystallized, filtered, dried, screened, and eventually bulk loaded or packed in bags. The process is continuous with an annual capacity of 60,000 tons of soda ash and 30,000 tons of borax.





Careful planning is evident in the layout of equipment, pipeways, and access platforms.

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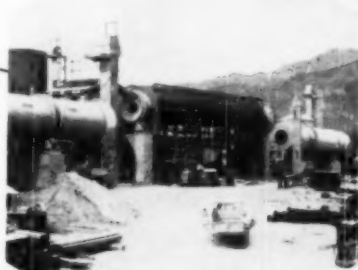


Carbonators, crystallizers, and evaporators were too large in diameter to move by train and had to be trucked in. Fluor rigging equipment took over, once the huge vessels arrived at the site.

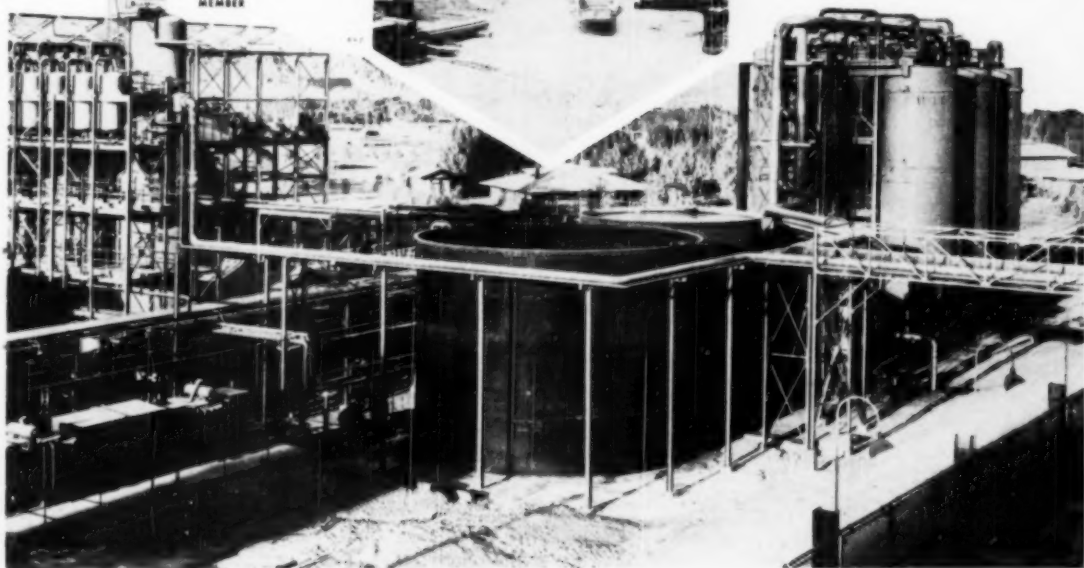
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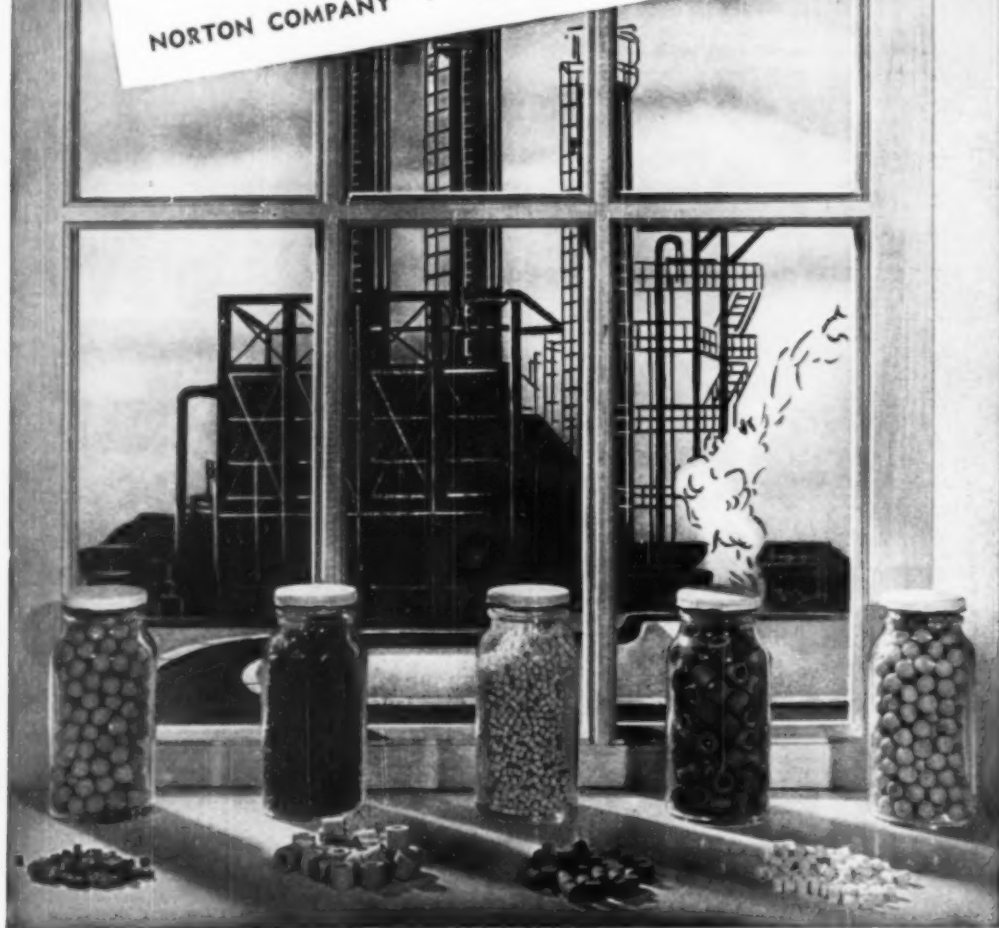
Fluor engineers utilized an ingenious way to get this 80-ton calciner in place. Foundations were poured, then 13 feet of earth fill was moved in by dozer and truck. On top of the fill, a spur track was laid to carry the giant. The same track also carried three hefty 60-ton driers. Track and fill were then removed.



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Norton Company manufactures Alundun (electrically fused alumina) Catalyst Supports in the form of porous granules pellets spheres and rings or tubular shapes. These are available in two grades of chemical purity and a wide range of sizes and certain variations can be made in the porosity and pore size. A number of catalytic operations required a alundun grain is suitable for these applications. For additional information as to chemical and physical properties and range of sizes of Norton Catalyst Supports write to:

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➔ Type LCE-1120 Heavy Duty Floodlight

This powerful 1500-watt floodlight greatly reduces the installation cost, lighting load and maintenance cost where large areas are to be lighted. The cast aluminum alloy housing is corrosion-resisting, and weatherproof. The 20-inch polished Alzak reflector can be furnished for either a narrow or wide beam. The narrow beam is ideal for very long range projection. Five types of lenses can be furnished. Horizontal and vertical stops facilitate relamping.



➔ Type ADE-16 Heavy Duty Floodlight

This sturdy cast aluminum alloy, 1000-watt floodlight will give you all the advantages of type LCE-1120 but in a smaller size — with a 16-inch polished Alzak reflector. Frequently it will cost much less to project light a considerable distance with Crouse-Hinds long range floodlights than to run cable and install local lighting. There are also indoor locations in large buildings where floodlights are the most economical and satisfactory source of light.



➔ Type MUA Alumalux Floodlight

Industrial yards and auto parking lots are most efficiently lighted by the use of floodlights. Crouse-Hinds Type MUA Alumalux 1500-Watt Floodlight provides efficient lighting at minimum first cost. It is widely used for general floodlighting and is ideal for the lighting of athletic fields and playgrounds.



➔ Type RLEE Explosion-Proof Floodlight

This heavy duty explosion-proof and weather-proof 500-watt floodlight has a cast aluminum alloy housing. It is designed for service in locations that are hazardous because of the presence of explosive atmospheres containing gasoline, naphtha, petroleum, benzol, alcohols, acetone, lacquer solvent vapors, and natural gas. It can be furnished with either a wide or narrow beam 13-inch Alzak aluminum reflector.



➔ Type RCDE-8 Explosion-Proof Floodlight

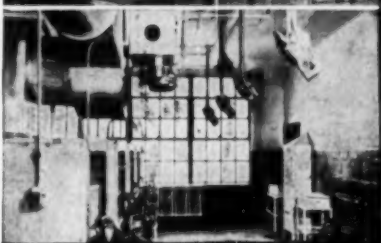
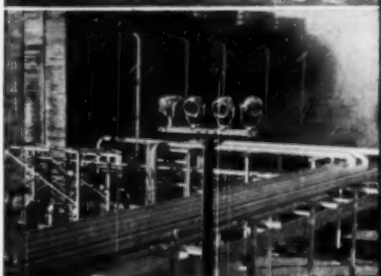
This is an explosion-proof floodlight in a 200-watt size, with an 8-inch reflector, either wide or narrow beam. It can be furnished for suspension mounting, standard base mounting, or as a portable floodlight with a handle and wheel base.



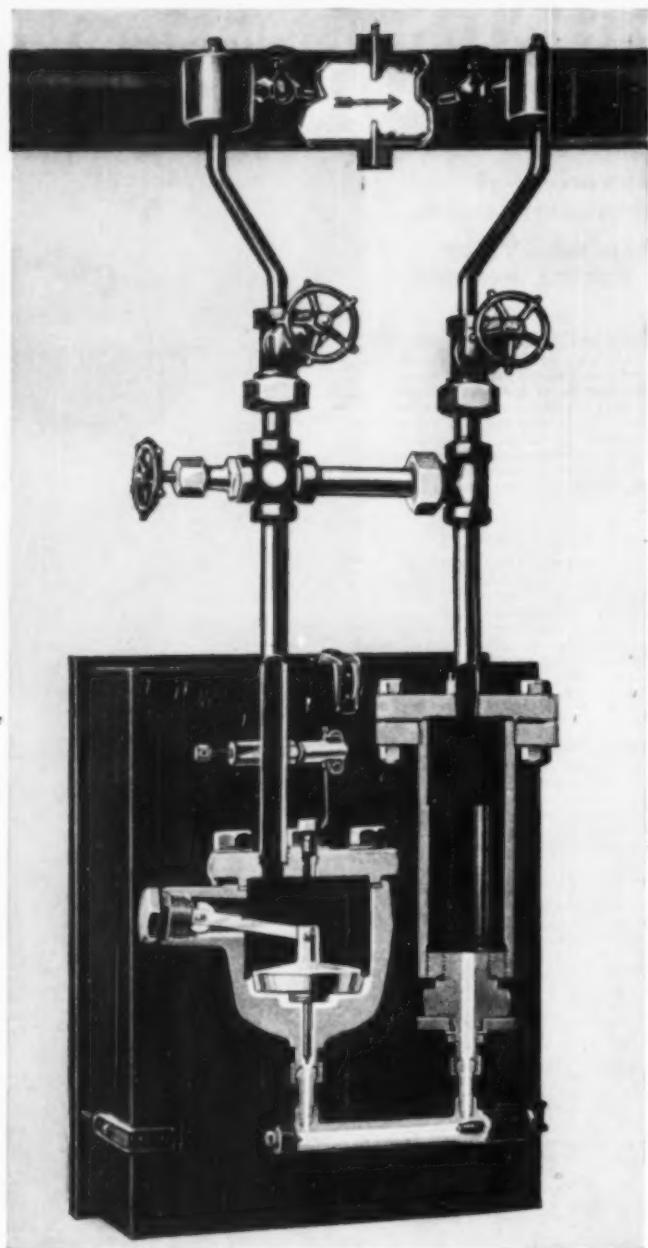
*Alzak is the registered trade mark of the Aluminum Company of America

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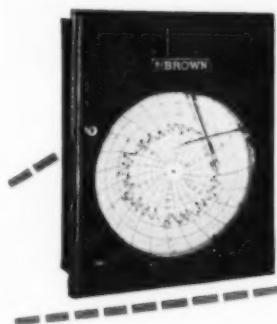
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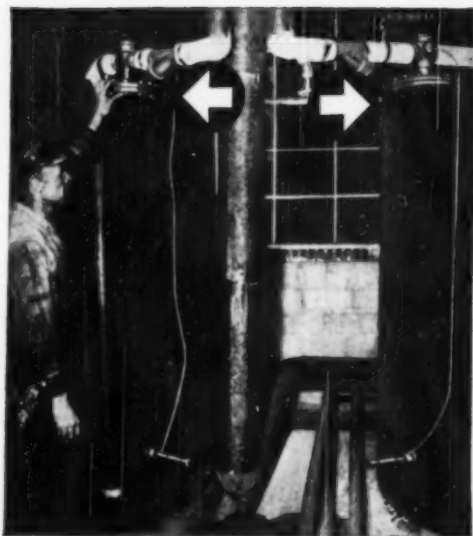
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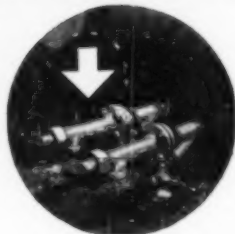
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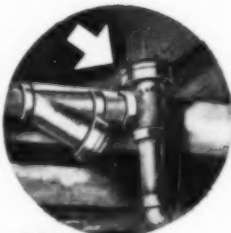


Sarco 2430
Control on wax
storage tanks

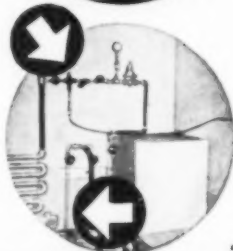
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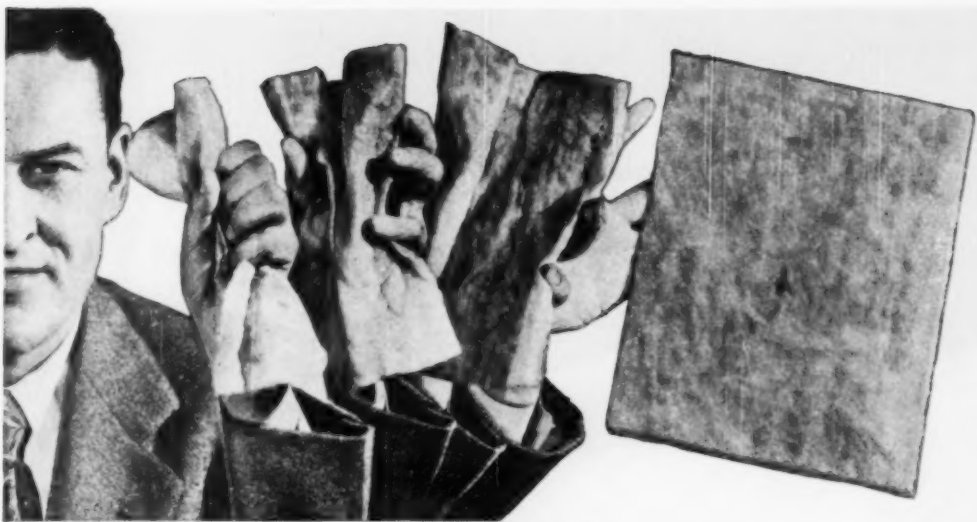
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Chemical Engineering

WITH CHEMICAL & METALLURGICAL ENGINEERING

JUNE 1949

Another Buyers' Market?

"Wanted: Chemical Engineers." So read a recent headline in *The Chementator*, commenting on an employment survey by the U. S. Bureau of Labor Statistics. Judging from the letters we have had from certain pavement-pounding members of our profession, there is some disagreement with the bureau's conclusion. More discerning readers probably realize, however, that the government's survey referred not so much to the current situation as to the long-time demand due to (1) growth of the chemical industry; (2) increasing use of chemical engineers in other process industries and (3) expanding research and teaching demands.

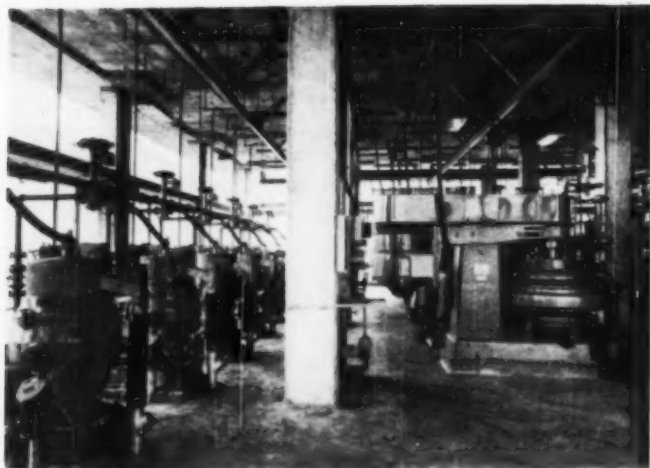
Within the month we have talked to several hundred student chapter members of A.I.Ch.E. at their regional conferences in New York and Syracuse. All seem to have a keen interest in the employment situation for it is obvious that many of the boys are still looking for jobs. Some schools have revived their former practice of publishing personal data sheets to be circulated among prospective employers. Others are starting intensive cultivation of smaller local industries that have not always recognized the values in employing technical personnel.

All this makes most interesting and timely another survey recently completed by a committee of the Engineers' Joint Council. Its questionnaires on 1949 employment programs for engineering graduates went out late in January and the returns were tabulated through the latter part of March. They covered a sizeable sample—155 industrial companies and 27 governmental agencies that currently employ 76,000 engineering graduates, or over one-quarter of the entire profession.

These organizations reported that they had hired 9,800 "inexperienced" engineering graduates in 1948 and estimated that they would hire 7,560 or about 23 percent less in 1949. For chemical companies the drop was but 9.5 percent as compared with 26.4 percent for all industrials. The 1949 quotas included 993 chemical or ceramic engineers for which the average starting salaries were higher than for any other group—\$275 per month for bachelors, \$315 for masters, and \$400 for doctors. These compare with over-all averages of \$260, \$300 and \$375, respectively, for all engineering graduates. A median monthly increase of \$30 is given by the end of the first year by concerns seeking mainly chemical or ceramic engineers. For 1430 graduates who had been out of school ten years in 1948, the median salary was \$450 per month—20 percent more than it was for ten-year graduates reporting in 1946.

These figures, it seems to us, are not too discouraging. They do not necessarily apply, of course, in all sections of the country nor to the graduates of all schools. But they confirm, at least in a general way, the views of those of us who have refused to be pessimistic about the future of the chemical engineering profession. There are still plenty of opportunities for men who will leave the beaten paths to apply their training to new jobs in untried fields.

It takes energy, imagination and initiative, as well as value, to make a sale in a buyers' market. From what we have seen of this year's crop, most of the engineering graduates are willing and anxious to accept that challenge. During the next few months, you as a potential employer will have an opportunity to make some good investments in technical personnel.



PROCESS INNOVATIONS. For one (there are many more), these centrifuges replace settling tanks and classifying tables. Even traditional Buhr mills are out.

The New Corn Products Plant: It Makes

Process-wise, it brings wet-milling up to date (flowsheet,

J. V. HIGHTOWER

In a number of respects, both as to processing innovations and architectural distinction, the Bluebonnet plant that Corn Products Refining Co., completed this spring at Corpus Christi, Tex., is a notable development in the wet milling industry.

Bluebonnet is the first plant designed specifically to process sorghum grains, although it could handle corn if necessary. At present the intention is to process sorghum grains at the rate of 20,000 bu. per 24-hr. day, and to produce at the same rate 300,000 lb. of dextrose, 330,000 lb. of starch, 300,000 lb. of stock feeds and 20,000 lb. of edible oil. However, the layout of the plant and its major equipment permit a tripling of this output.

The plant is the outgrowth of experimental and pilot plant work done by the company several years ago and collaborative process design work carried out by Corn Products and The H. K. Ferguson Co., the general contractor. Improvements and innovations were suggested by a study of

the company's other mills at Pekin and Argo, Ill., and North Kansas City, Mo., all of which were designed primarily to process corn.

Another factor contributing to the modernity of the Bluebonnet plant has been the development of new equipment and construction materials since the last completely new wet milling installation in this country was built by Corn Products at North Kansas City in 1922.

The company selected Corpus Christi as a site because of the suitability of the region for growing sorghum grains. In that vicinity is planted a dwarf variety of grain characterized by a relatively low, uniform height of plant suitable for combine harvesting. The company plans to buy grain within a 50-mi. radius, or farther if necessary. Availability of natural gas, of course, was another consideration. The mild climate, permitting the maximum use of out door construction, was an encouraging element from the investment standpoint.

One of the praiseworthy attitudes of large manufacturers building plants in the Southwest has been their decision to spend money on installations that please rather than offend the eye. The major buildings of this large

plant are widely spaced. Arcs around them are grassed and are planted with palm trees, in keeping with the general appearance of the coastal city of Corpus Christi, a few miles east of the plant. Particularly attractive is the administration-laboratory building, which is reached by a double-lane drive, lined with palms.

One of the architectural features is the absence of a mass of unsightly electric power lines and process piping. This type of disfigurement has been largely eliminated by a concrete tunnel, approximately 13 ft. high by 12 ft. wide, that carries utility piping. Power cables are carried in a separate underground system.

In the following description of the process operations will be evident the numerous innovations and widespread use of modern engineering materials that set the plant apart from others in the wet milling industry. These features are designed to improve overall operation and to minimize maintenance costs.

If grain is brought in by truck, the truck is driven onto a scale platform equipped with a mechanism by which, after weighing, the front end of the vehicle is raised, permitting the grain to slide into a hopper where it is

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ARCHITECTURAL DISTINCTION. Here's proof that chemical plants can please the eye and still be functional. But it takes effort (Chem. Eng., Sept. 1948).

Wet-Milling History

p. 144). Architecturally, it's way ahead of the game.

moved successively by a screw conveyor, bucket elevator and belt conveyor to any desired point at the grain building. If brought in by box car the grain is unloaded by a pneumatic conveyor into a scale garner and thence into a weight tank. Once the consignments of grain have been weighed, the material is passed through a cleaning and scouring operation, then either to storage, the steep house or a Randolph gas-fired dryer having a capacity of about 1,500 bu. per hr. depending on moisture content. The cleaners consist of three units which combine air separation and screening. Three scourers remove glume from the grain; they combine air separation and rotary beating.

The storage system consists of 56 concrete tanks and 36 interstices, the combination having a total capacity of 2 million bushels. A temperature indicating system, which permits the observation of grain temperatures at every 5 ft. of height, allows the detection of any heating during storage.

From the start to the end of the series of processes through which the grain and its components pass on their way through the plant, the use of instruments is considerably more extensive than in any other wet milling

plant. At the beginning of the long journey from storage or the dryer, for example, the grain, on its way to the steep tanks, first passes into a weigh tank from which the desired amount for each tank is automatically released upon the belt conveyor by an automatic belt scale.

STEP 1: STEEP

There are 20 steep tanks, each with a capacity of 2,500 bu. These vessels have cypress walls and cast iron, cone bottoms, such materials being used to resist the corrosiveness of the steep water.

The water employed in the steeping process is that which is returned from other departments, and contains around 400 to 500 grains of soluble materials per gallon. The water, before entering the tanks, is pumped through two sulphur dioxide towers in series flow and cascades down over trays. Towers and trays are of cypress. Moving countercurrently to the water in each of the two towers is sulphur dioxide produced by burning sulphur in a horizontal rotary furnace. As in the steeping of corn, the function of the gas is to control the growth of organisms so that only those beneficial types are allowed to propagate. The

water is advanced through the system of steep tanks so that the freshest water first contacts the grain that has been longest in the system.

A temperature of 125 deg. F. is maintained in the steep tanks and about 60 hr. is normally needed for the proper steeping of the grain. Such conditions are required to condition the grain for efficient separation into its components of starch, oil, protein and fiber.

Corrosion-resistant materials are widely used at all points where products containing SO_2 are handled or likely to be encountered around the steep house. This also applies to the mill house. In the steep house and mill house, process piping with a diameter of more than 3 in. is lined with vitreous enamel. All lines 3 in. in diameter or smaller are of copper. All areas under the pumps are lined with acid-resistant brick set in a phenolic cement. Piping used to flush the steeped grain to the mill house has fired ceramic lining. In the mill house all tanks with capacities of 600 gal. or less are of stainless steel composition, and all tanks over 600 gal. are stainless-lined.

STEP 2: TAKE GERM OUT

After the grain has been steeped, the water is withdrawn from the steep tanks and pumped to the feed house. Here it is concentrated in a triple effect evaporator, and the resulting heavy sirup is combined with protein stock feed produced in a manner to be described later.

The steeped grain is delivered to the mill house by use of an unconventional system whereby the grain is sluiced with process water that is subsequently returned to the steep house. Dewatering is carried out on stainless steel Rotax screens. The grain is dropped to a stainless steel grind control hopper. The grind controller is an Omega belt type feeder which permits grinding at a predetermined rate. From the feeder the grain is discharged to three degerminating mills, which are single runner, 36-in. plate machines operating in parallel. These mills break up the grain to permit the most efficient recovery of the germ.

The ground material moves by gravity to seven germ separators, which are open cast iron troughs where the specific gravity of the starch suspension is maintained at such a point as to float the germ from the fibrous portion of the grain. The germ is then passed over three groups of screens where adhering starch is removed by successive dilution with water. The germ is moved next to pulp presses which remove a large por-

tion of the water, which is then returned to process.

In the next step of processing the germ the material is dropped by gravity from the pulp presses into a rotary dryer heated with internal steam tubes. The rate of entry of germ into the dryer is so controlled as to maintain the residual moisture content of the product leaving the dryer at about 4 percent. After being elevated by an air stream to a hopper the germ is distributed to three oil expellers equipped with cookers and conditioners. Water is added at the conditioners and the germ is kept at a temperature of 250 deg. F. to condition it for the most efficient recovery of the oil as it passes through the expellers. In these expellers the germ is moved on internal screw conveyors within a heavy slotted barrel designed to maintain the high pressures required to expel the oil. The oil is filtered in a plate and frame press and is then ready for shipment in tank cars to the company's plant at Argo, Ill., for refining. The volume of oil produced at Corpus Christi is not large enough to justify the installing of refining equipment there. The cake from the expellers is moved by a screw conveyor to a cake mill where it is ground prior to being combined with other stock feed components produced in steps to be outlined next.

STEP 3: MILL OUT COARSE FIBER

Returning to the germ separators, the water slurry of starch and fiber from the separators is pumped over dewatering screens. The fibrous material is then discharged to one of three disintegrators for starch recovery and the separation of coarse and fine fiber. Use of the Rietz mill for this service is new to the wet milling industry. The conventional plant employs a Buhr mill for such service. Engineers at the Bluebonnet plant point out that use of the Rietz machine eliminates the coarse fiber washing system, improves recovery of starch, decreases maintenance costs.

The disintegrators, in combination with the Sprout-Waldron repulping machines, do the work of the older Buhr mills. Experimental studies at Argo showed that maintenance with this combination is likely to be less. Buhr mills require redressing every four or five days, during which time the mills are out of service for about 24 hours. It is supposed that a Rietz mill will have to be taken out of service only about once a month and can be restored to service within approximately 4 hours. In addition, the Rietz and Sprout-Waldron machines require appreciably less floor space

than would have been needed for a system of Buhr mills doing the same work. Finally, there is increasing difficulty of finding men skilled in the art of dressing the Buhr stones.

Because it handles slurry containing SO₂, the Rietz is of stainless steel construction. Unusual features are the use of a 360-deg. screen and the use of hammers mounted on a vertical drive shaft. Twenty-four hammers are fixed between 12 circular plates on the shaft and revolve inside the screen with a clearance of about $\frac{1}{8}$ in. at 3,600 rpm. The fibrous slurry enters the machine at the top and as it is driven toward the screen the fiber separates into a fine portion that moves through the screen and a coarse portion that is discharged from the bottom of the machine. A spray of process water is used to wash the coarse fiber free of starch before it leaves the machine.

At this point it seems advisable to trace the flow of materials that ultimately become bagged stock feed of 23 percent protein content. The coarse fiber discharge from the Rietz mills is sufficiently dry to be transported by a stream of air to the feed house. There the material is passed in parallel through three pulp presses, together with a portion of fine fiber from the Rietz operation, for the final dewatering. The material discharged from the presses is combined next with the heavy steep water sirup from the triple effect evaporator previously mentioned. This mixture is then conveyed to a flash feed dryer, which is a gas-fired furnace discharging hot gases to a cage mill where the wet mixture of sirup and fiber is introduced. The mixture is then drawn through an air transport tube by the hot gases and discharged into a cyclone; partial drying of the sirup-and-fiber mixture takes place during its movement through the transport tube.

An advantage of the flash dryer over other types that have been used in wet milling is that it is possible, through the rapid action of the flash principle, to obtain stock feeds of appreciably lighter color than would be otherwise produced.

The partly dried material is next moved by screw conveyor to a second-stage dryer of the type described above. Finished feed drops by gravity from the dryer to a rotary cooler, thence to packing hoppers, and is finally packed in 100 lb. bags.

STEP 4: SCREEN OUT FINE FIBER

It is now desirable to return to the milling operation where the fine and coarse fibers are separated, and follow from there the course taken by the

fine fiber, starch and gluten.

The mixture of these three materials is discharged through the screen of the mill and passes over a set of dewatering screens. The filtrate, containing starch and gluten, drops into a feed tank supplying a string discharge drum filter. Filtrate from the drum is returned as steep water to the grain steep tanks. The filter cake is slurried with water and is handled as described below.

The fine fiber retained on the screens is discharged into two 36-in. double headed Sprout-Waldron repulping mills for the recovery of additional starch bound in the fiber. It has been mentioned above that these mills, used in conjunction with the Rietz disintegrators, take the place of a system of conventional Buhr mills. The Sprout-Waldron is substantially a machine of standard design but is fitted with specially selected attrition plates of cast alloy metal of great hardness. The grooved and ribbed plates are mounted on two oppositely revolving motor-driven horizontal shafts each moving at a speed of 1,200 rpm. Clearance between the opposed plates is 0.002 to 0.003 in. and is adjustable. Fine fiber enters the housing enclosing the two rotating wheels and passes through openings in one wheel to get between the attrition plates. The repulped material is then discharged from the base of the housing.

The fine fiber discharged from the repulping mills is diluted with wash water and pumped to screens equipped with nylon bolting cloth. Here occurs the separation of fiber and dilute starch slurry. The process of dilution with water and subsequent separation on a screen is performed a total of four times in series operation. The finally washed fiber is then pumped, along with water, to the feed house where it is combined with gluten and processed, as described below, to 41 percent protein stock feed. However, a portion of the fine fiber is combined with the coarse fiber and dewatered in the three pulp presses previously mentioned in describing the conversion of the coarse fiber into 23 percent protein stock feed.

STEP 5: SPIN STARCH FROM GLUTEN

The combination of fine fiber with the gluten occurs as follows: It has been pointed out that the fine fiber-gluten-starch mixture discharged through the screen of the Rietz disintegrator is separated on screens into (1) the fiber and (2) the gluten-starch mixture which is then obtained as a cake on a string discharge drum filter. The cake, after being slurried with water, is first pumped to a second

string discharge drum filter where it is washed and then discharged to Merco centrifuges for separation of starch and high-protein gluten.

The Mercos operate at 2,500 rpm. The starch-gluten slurry enters the bowl of each machine and is discharged into the bowl near the bottom. The relatively light gluten begins to move upward and is discharged at the top of the bowl. Meanwhile, the starch is forced to the periphery and is discharged through 20 nozzles in the bowl; it leaves the centrifugal and enters a vent box, a container with a capacity of over 100 gal. A stream of product starch is withdrawn from the bottom of the box, while a portion of the material is drawn off from the surface of the starch in the box and recycled along with wash water to the centrifuge, entering at the bottom of the bowl.

The vent box is a device for releasing entrained air, removing high protein foam and for increasing the volume of starch being handled by the machine. By varying the rate at which product starch is being removed from the box at a given feed rate, and maintaining a fixed relationship between the feed rate and rate at which the wash water is added, the density of material in the machine can be controlled so as to obtain the best separation of the starch and gluten. Flow ratio controllers are used to maintain a constant ratio of feed rate to wash rate, whereas the usual procedure with such machines is to maintain a constant wash rate regardless of the movement of feed.

The separation in the centrifugals is accomplished in two passes of three machines each. The first pass produces a high-protein gluten and an impure starch fraction. The second pass produces a low-protein gluten fraction, which is recycled to the first pass, and a pure starch ready for final washing. The second pass group of centrifuges operates on the starch from the first pass group, which throws out the gluten.

The gluten from the first-stage group is pumped to De Laval dewatering centrifuges for concentration. The concentrate is then pumped to the feed house, where it is dewatered on three string discharge, drum filters. At these filters a portion of the fine fiber is added to the concentrated gluten slurry and the fiber-gluten cake from the filters is discharged to flash dryers similar to those used in the previously described production of 23 percent protein stock feed. Here, the dried product is 41 percent protein stock feed. It is sold either in bulk or in 100 lb. bags.

With reference to the Merco centrifugal system, this is an important departure from conventional practice. The separation at this point has been previously performed by the use of long, narrow "tables" over which the starch and gluten slurry was allowed to flow at a controlled rate. During such operation the heavier starch particles settled out and the lighter gluten particles were carried over the ends of the tables by the slurry water. The advantages of the centrifuges over tables are the greatly reduced requirement for floor space needed per bushel of grind, improved housekeeping and improved quality of products.

A comparative estimate of floor space requirements for tables vs. centrifugals is interesting. If tables were used, it is considered that 40,000 sq. ft. would be necessary to handle a daily grind of 20,000 bu. of original grain, or 50,000 sq. ft. to handle 25,000 bu. of grain, is approximately 1,500 sq. ft.

An additional advantage in using the centrifugals is that the time required for handling a given volume of starch-gluten mixture is much less, resulting in a great reduction in inventory. If tables were used, the material would be on them for 4 to 6 hr., whereas it is retained in a centrifuge for only about one minute.

The use of the De Laval dewatering centrifuges is also a new application. Conventional practice has been to use large settling tanks, with settling periods up to 24 hours. The rapid action of the centrifuges contributes to keeping the system fresh and minimizing bacterial growth.

Throughout the wet starch process, rates of flow, concentrations, temperatures and tank levels are controlled by instruments. Instrumentation of the Merco machines, in particular, is a departure from prior practice in that an effort was made to control completely automatically the operation of the machines with respect to feed supply rates, concentrations and water wash rates. Feed rates are governed by automatic flow controllers that maintain a constant feed tank level.

Attention can be devoted at this stage to the processing of the starch obtained from the second pass group of Merco centrifuges. Diluted with water, the product is filtered on two drum type, vacuum filters. Here, fresh water used for the first time in the entire starch plant processing is introduced as wash water. An intricately coordinated system of piping permits the multiple use and reuse of water that initially enters the processing at

these filters. Throughout the starch plant processing, no water is sent to sewers. Water losses occur solely through evaporation where the steep water is evaporated to sirup, where the starch product is dried, or in the form of moisture in finished products.

Washed starch cake from the filters is reslurried and pumped to the starch drying house or to the sugar refinery. Turning for the moment to the drying and bagging of starch, the slurry is dewatered, discharged over cleaners to remove any foreign matter, given an additional fresh water wash on two drum type string discharge filters and then passed through two traveling belt, continuous dryers heated by steam coils. The starch from the dryer is carried by means of a Fuller-Kenyon air pump to the packaging building for packing in 100 or 140 lb. bags. The product is weighed and packed with the use of a Merrifield scale, another new application for such service.

With respect to the Fuller-Kenyon pump system, the dried starch containing not over 12 to 14 percent moisture is moved from the dryer by means of a Redler elevator and discharged into a hopper. A motor-driven horizontal steel screw at the bottom of the hopper continuously carries the starch from the hopper and discharges the material into the larger end of a conical chamber. There, three air jets impel the incoming starch at an air pressure of 5 to 10 lb. to the smaller end of the chamber, where the mixture of air and starch is discharged into a 4-in. pipe and carried in the pipe to a receiving hopper at the packaging building. The vertical distance from the pump to the top of the hopper is approximately 75 ft. Very little starch is lost when the air is vented through a dust collector.

STEP 6: MAKE SUGAR FROM STARCH

As to the conversion of starch to dextrose: That portion of the starch which is to be converted is taken in slurry form from the vacuum filters and is continuously and automatically acidified with sulphuric acid. The acidified product then moves to a continuous converter where, in the presence of steam, it is converted to a light dextrose sirup. Bentonite is added to the sirup to aid in the removal of residual fats and proteins. The bentonite, with these impurities, is removed by means of two Oliver precoat filters operating in parallel. The cake is discarded.

The continuous converter is the first such unit to be used on a commercial scale for the manufacture of dextrose sugar, although this is not true for the production of sirup. In the opera-

tion of the converter at the Bluebonnet plant a mixture of starch, dilute sulphuric acid and steam enters a chamber and then passes through 32 vertical copper tubes of 8-in. diameter connected in series. The tube assembly has a total length of 600 ft. Tubes are insulated with glass wool. The temperature in the system is about 320 deg. F. The material passes through the tubes and emerges after a total resident time of 12 min. Since the converter is continuous in operation the resident time for all starch that passes through it is constant, a fact that permits high efficiency in conversion.

Also noteworthy is the fact that the precoat filters that receive the sirup from the converter are controlled entirely automatically with respect to precoat, filtration of sirup, washing off of the coat and application of the new coat. These operations are managed by a cycle controller of Corn Products design. Former practice was to perform such operations manually.

Clarified sirup from the filters is discharged by gravity to carbon treating tanks where once-used activated vegetable carbon is introduced to reduce color and remove impurities. These are cylindrical vessels of stainless steel, such metal being used because of the acid nature of the sirup up to this point. The carbon-sirup mixture is separated in three Sweetland pressure leaf filters operating in parallel. The carbon is washed on a drum type, vacuum filter to recover residual sugar. At this point the carbon is discarded.

Clarified sirup from the Sweetlands is pumped to the ion exchange system where the acid is removed, as well as residual color and other impurities. Once more, it is interesting to note that the use of the ion exchange principle is a new departure in wet milling. Conventional practice has been to neutralize with sodium carbonate and then decolorize and refine the sirup over bone black. Engineers involved in designing the Bluebonnet plant concluded that the ion exchange system has advantages over the older practice.

They point out that the ion exchange system eliminates the appreciable capital investment required for a bone black revivifying unit. They also are convinced that with this system the yield of sugar is higher, considering the relatively large loss of sugar that would be entailed in bone black processing. Finally, they point to the comparatively higher purity of sugar obtainable by the ion exchange process. This process is the first commercial application to the wet milling industry for the refining of dextrose sir-

ups, although Corn Products has a commercial unit operating on corn sirup at Pekin, Ill.

In this system the sirup from the converter is passed successively through a series of ion exchange columns consisting of vertical carbon steel chambers with rubber linings. Piping for the system is largely stainless steel. At any one time, six columns are on stream and two are being regenerated.

A centrifugal pump moves the sirup into the first of the six columns—the anion column, where are removed acid radicals, such as sulphate, carbonate, etc. Under the influence of constantly decreasing air pressure superimposed in this and succeeding columns, the sirup moves successively from the first anion column into an alternating succession of cation and anion towers. In the cation chambers, any metals present are removed. Both types of columns have a further refining influence with respect to organic impurities, including color-forming agents.

From 500 to 400 lb. of sugar (dry basis) per cu. ft. of ion exchange material is purified before regeneration is necessary. It is expected that between 500 and 1,000 regenerations of material will be practicable before it will have to be rejected. Anion columns are regenerated with an alkali; cation columns, with an acid. The timing of the entire cycle is managed automatically by a timing device system, which, Bluebonnet engineers declare, is the first completely automatic arrangement involving the ion exchange system in the industry.

Effluent from the ion exchange system is given an initial evaporation in a rising film, triple-effect evaporator. The concentrated sirup is then treated with virgin vegetable carbon for further color removal. The carbon is taken out by passage through Sweetland leaf pressure filters, reslurried with water and pumped back for additional use in the carbon treating tanks mentioned above.

Filtrate from the Sweetlands is passed through a Sweetland precoat filter to remove the last traces of carbon. This clarified sirup is given a final evaporation in a single effect, falling film evaporator. The concentrated sirup is pumped to the crystallizer house and into cooling tanks to obtain the proper crystallizer filling temperature of about 120 deg. F. These tanks are lined with stainless steel, fitted with cooling water coils and are motor-agitated. The cooled, concentrated sirup is pumped to a system of 38 water-cooled crystallizers operating in parallel. This equipment, consisting of horizontal, cylindrical vessels with outside water jackets and inner coils,

is lined with stainless steel. Within three to four days, the sugar crystals are formed.

The crystal mass, or massecuite, is dropped into a mixer box where the mass is kept in constant agitation and supplied to centrifugals. The box is lined with stainless steel and has a stainless steel agitator running its full length. The centrifugals, 19 operating in parallel, are horizontal, stainless steel, basket machines. These separate the crystals from the mother liquor, which is returned to process. Details on the handling of the liquor have not yet been disclosed.

The centrifugals are conventional perforated basket machines with individual motor drive. Massecuite passes into the baskets, mother liquor is thrown off and the crystals are discharged at the bottom. The process of charging and discharging each machine is manual; all other operations involved are automatic, including spinning off the liquor, adding a controlled amount of wash water, and spinning dry. This degree of automatic control is another departure in the industry, where prevailing practice is manual operation throughout. The total elapsed time for charging a basket, spinning off liquor, washing, spinning dry and discharging is only about 30 min.

The crystals discharged from the centrifugals are dried in a rotary horizontal cylinder using hot air in direct contact with the crystals. The dried sugar is then cooled in a rotary horizontal cooler where cool air is injected, and the product is next conveyed by a Redler chain elevator to the packaging building. There the sugar is screened on a vibrator for the removal of any oversize material, which is returned to process. Screened sugar drops to a hopper and a scale automatically controls the movement of sugar into the bags.

In the sugar refinery the extensive use of corrosion-resistant materials is adopted in order to minimize corrosion and maintain purity of product. Piping, with exception of utility lines, is of stainless steel or copper. Tanks are lined with stainless steel. Stainless tubes are used in the single-effect and triple-effect evaporators. All Sweetland presses are stainless lined and have stainless leaves. The filters are also of stainless steel.

The list of plant officials includes J. F. Morton, manager; F. W. Holm, superintendent; F. A. Giesecke, plant engineer; G. R. Kramer, wet and dry starch superintendent; H. M. Ewing, refinery superintendent; and T. H. Pierson, instrument superintendent; R. F. Heuhner, process engineer and R. W. Bond chief chemist.

Make a list of all the equipment the new plant will need.

Prepare complete process flowsheet, material balance, and heating and cooling loads. Be sure to include adequate facilities for raw materials and product storage, packaging, shipping and waste disposal. Many estimates fall down here rather than in the actual as-

signment of dollar values. Then, from the basic engineering and process considerations involved, decide upon the type of equipment best suited for each step and determine its size and materials of construction. Make a tabulation listing each piece of equipment with its appropriate description.

Use curves on next eight pages to estimate equipment's installed cost.

Enter a dollar value opposite each item on the list to represent its probable installed cost. On pages to follow are 22 charts that can be used to obtain the cost for many standard types of equipment. Estimation of the cost of equipment not covered by the graphs or of a specialized nature may sometimes be approximated from the available

curves. For example, cost of a tubular reactor might be figured from the data on heat exchangers, with allowances for high temperatures and pressures, cost of catalyst, etc. Or the cost of a stainless-clad pressure vessel might be obtained by interrelating the data on stainless-clad storage tanks with that for steel pressure vessels. Total these dollar values to get "installed equipment cost."

Use factors on page 106 to go from equipment cost to total-plant cost.

From the tabulation on the last page of this article select appropriate percentage factors for process piping, instrumentation, outside lines, manufacturing buildings, and auxiliary facilities. The sum of these factors is then applied to and added to "installed equipment cost" to obtain "total physical cost." Simi-

larly, select appropriate factors for engineering costs, contingencies, and size, and apply to the "total physical cost" to obtain the probable total project cost. This figure must then be adjusted to the current or forecasted Construction Cost Index by multiplying by the ratio of the selected index to the base ENR index of 400.

An orderly, systematic way to estimate the cost of a new plant. Du Pont engineer releases new cost data, but even more important—he brings order to the chaotic mass of data that's already been published

COST DATA CORRELATED

CECIL H. CHILTON

Estimates of construction costs for process plants may assume any of several forms, depending upon the time and information available to the estimator and the use for which the estimate is intended. Except for unusual

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instances in which the stakes are high—such as a war emergency plant or a competitive race to get into early production—appropriation of funds for process plants is based upon firm estimates of construction cost. The allowable accuracy of the firm estimate may vary somewhat. For the construction by the owner or by a contractor under a cost plus arrangement, an error of plus or minus 10 percent may be tolerable. For a fixed sum contract, however, the required accu-

EQUIPMENT COST DATA . . .

racy will probably be somewhat greater.

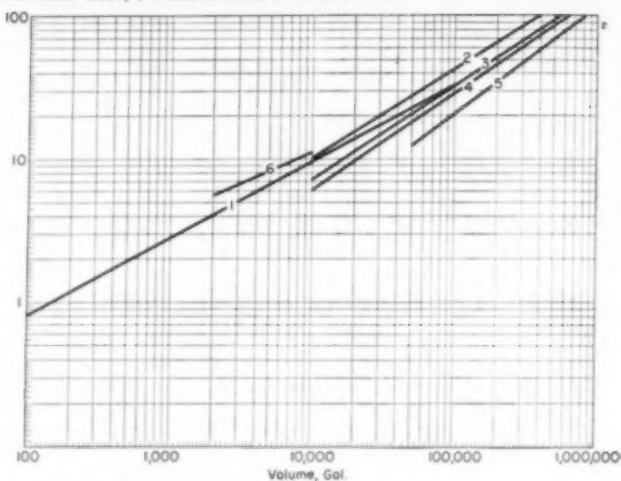
Firm estimates are based upon detailed plans and specifications for each item involved in the project. Equipment costs are usually obtained directly from manufacturers' quotations and installation costs calculated from estimated man-hours and prevailing labor rates for the various crafts. Piping costs are based upon actual requirements as taken off the piping drawings. Cost of structures is similarly estimated by labor and material takeoffs of steel, concrete, brick, tile and so on. This type of estimate is usually prepared by an experienced estimating group.

WHY MAKE "PRE-DESIGN" ESTIMATES

In the development of ideas which are eventually to result in commercial process plants, frequent economic appraisals are made in order to eliminate from active study those developments in which the return on investment would be too small and to concentrate research and engineering efforts into channels leading to the most attractive end results. These economic appraisals obviously must be made without the benefit of firm estimates based upon detailed design. Some indication of the cost of constructing the commercial plant is required, however, so an estimate is prepared, sometimes by a chemist or engineer closely concerned with the development, or at other times by a chemical engineer with previous estimating experience and a reference file of cost data. This type of estimate, while varying widely in the amount of time spent in developing the necessary data and in the dependability of the result, may be broadly termed the "pre-design" estimate. It may range all the way from the research chemist's "guesstimate" to the engineering department's preliminary estimate which defines the scope of the engineering work involved.

Pre-design estimates are useful not only in guidance of research into the most profitable channels but also in the selection of the most desirable of several process or design alternatives. For example, if it is required to recover a condensable vapor from a large volume of non-condensable gas, the process engineer must make a selection from various alternative methods, such as compression, refrigeration, absorption or adsorption. It is usually not necessary to prepare complete designs and obtain quotations in order to make the proper selection of method, as pre-design estimates of each method can be used for guidance except where

INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)

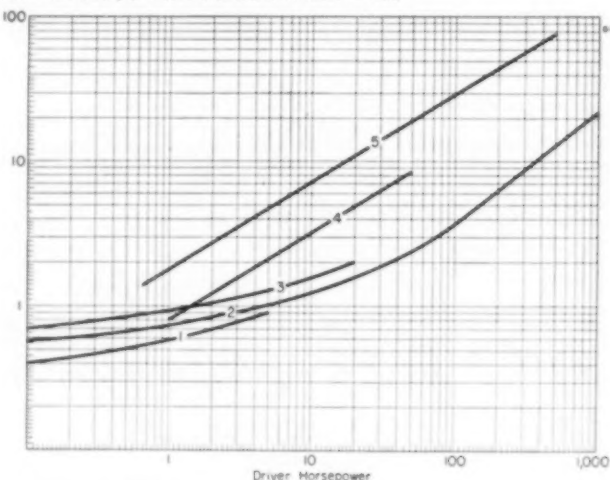


Steel Pressure Tanks*

Curve	Description	Source*	Reliability*
1	Cylindrical tanks	P	G
2	Spheres, 100 psi	P, 20	F
3	Spheres, 50 psi	P	F
4	Spheres, 25 psi	P, 20	F
5	Spheroids, 15 psi	20	G
6	Chlorine tank cars	10	F

Notes are on last page of article.

INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)

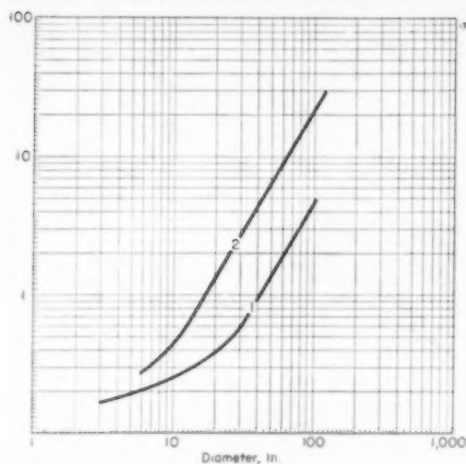


Liquid Pumps

Curve	Description	Source*	Reliability*
1	Rotary, iron	P, 20	F
2	Centrifugal	P	G
3	Iron	P	G
4	Stainless steel	P, 20	F
5	Triple reciprocating	P, 20	F

Notes are on last page of article.

INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)

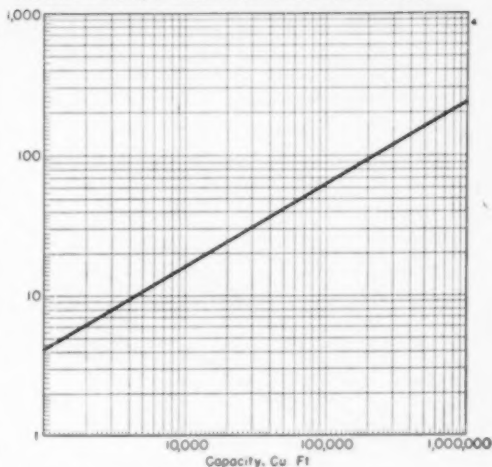


Cyclone Separators

Curves	Description	Source*	Reliability†
1	Steel	P	G
2	Stainless steel	P	G

Notes are on last page of article.

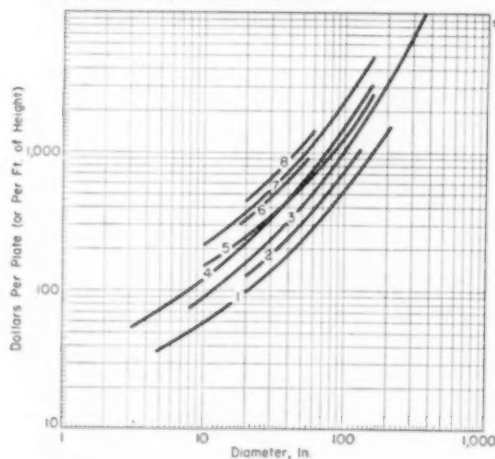
INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)



Gas Holders

Source: P. 20, 34. Reliability†: G.
Notes are on last page of article.

INSTALLED COST, \$ (Basis: ENR Index = 400)

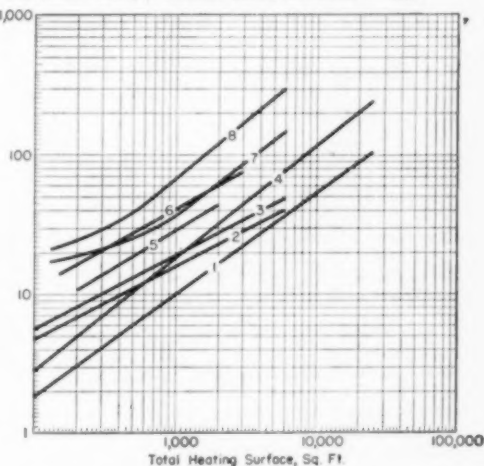


Towers

Curves	Description	Source*	Reliability†
3	Bubble plate towers		
3	Steel	P, 11	G
5	Copper	P	F
7	Stainless steel	P, 34	G
	Packed towers		
1	Steel	P	G
3	Copper	P	G
4	Stainless steel	P, 34	G
8	Silver-lined steel	P	Q
6	Glass-lined steel	P	Q
2	Have	P	G

Notes are on last page of article.

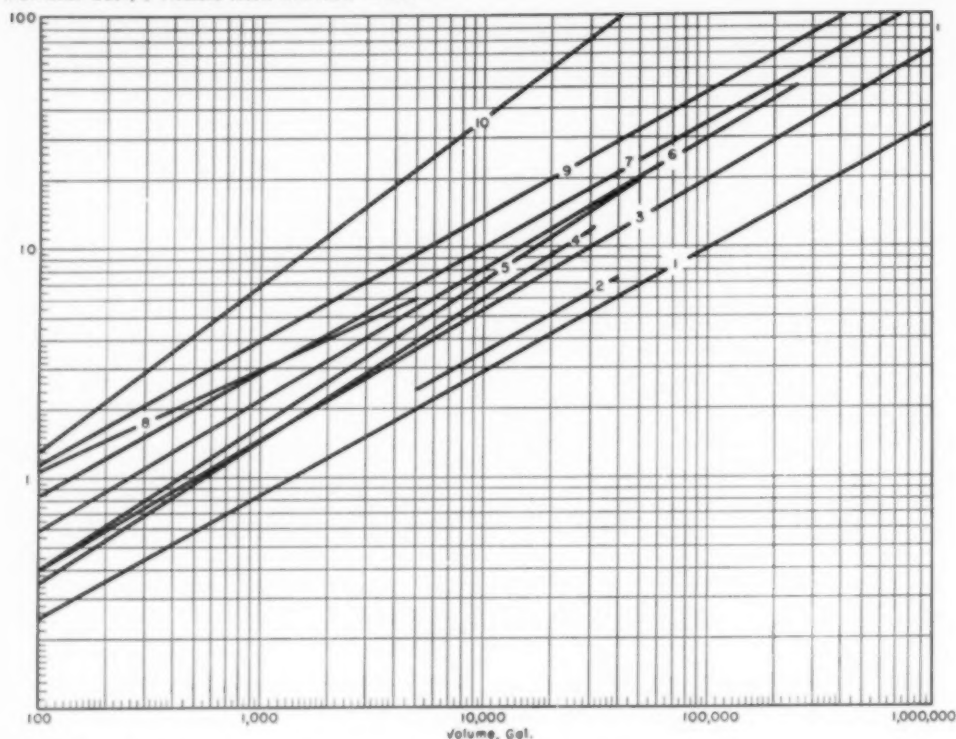
INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)



Evaporators

Curves	Description	Source*	Reliability†
2	Standard horizontal tube		
2	C. I. body, Cu tubes	8, 16, 26	F
12	All steel	16	Q
	Standard vertical tube or basket		
3	C. I. body, Cu tubes	8, 16, 26	F
3	All steel	16	Q
6	Lead-lined body, lead tubes	16	Q
	Long tube vertical		
4	C. I. body, Cu tubes	8, 16	F
1	All steel	8, 16	F
5	All copper	16	Q
	Forced circulation		
7	C. I. body, Cu tubes	8, 26	Q
8	Ni C. I. body, Ni tubes	8, 26	Q

Notes are on last page of article.



Storage Tanks

Curve	Description	Source*	Reliability*	Curve	Description	Source*	Reliability*
1	Steel	P, 15, 20, 33, 34	G	7	Monel-clad steel	P, 15	F
2	Aluminum	P	F	8	Inconel-clad steel	P, 15	F
3	Copper	P	G	9	Silver-lined steel	P	F
4	Monel	P, 15	F	10	Glass-lined steel	P	G
5	Type 304 stainless	P, 15	G	3	Rubber-lined steel	P, 10	G
6	Type 316 stainless	P, 15	G	2	Leather-lined steel	P	F
7	Stainless-clad steel	P, 15	F	3	Lead-lined steel	P, 7	F
8	Nickel-clad steel	P, 15	F				

Notes are on last page of article.

EQUIPMENT COST DATA . . .

the results are close and greater accuracy is required.

WHAT'S WRONG WITH EXISTING DATA

Preparation of a reasonably reliable pre-design estimate in a minimum of time may be hindered by lack of typical cost data for complete process equipment installations and related auxiliaries and the need for roughing out building sizes, length of piping runs, and other details to obtain the additional costs related to but not included in process equipment costs. Until rather recently such cost data were almost completely lacking in the published literature. Such data as have been published by various authors have been inconsistent as to the bases upon which the information was presented. In most cases the costs are for

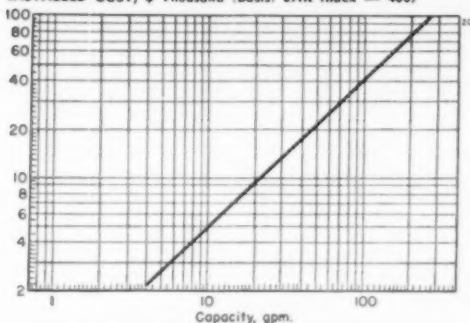
only the bare equipment; sometimes they include auxiliaries. Usually the costs of installation, including foundations, supports, wiring, and installation labor, are not given. And the figures reported are current for differing values of the Construction Cost Index, so that direct comparison of data from various sources is difficult.

The present work represents an attempt to compile and collate process equipment cost data from a number of published and private sources and to revise to a standard and consistent basis.

Although this compilation is far from complete as regards the inclusion of all types of equipment found in process plants (and, indeed, absolute completeness must remain a mere will-o'-the-wisp), it does cover many of the more common types of chemical equipment. No claims are made

as to absolute accuracy, and the fact that costs are stated as single dollar values instead of ranges in no way implies that the actual cost cannot be appreciably more or less than the given dollar figure. In correlating the available data, considerable variation was found. Two-fold differences, even within a single detailed estimate for a given project, were not uncommon. The reasons for these variations are usually well founded, and the need for final detailed estimates prior to authorization of construction work is forcibly emphasized thereby. The final correlations presented here are considered a good average of the available information, with data from various sources being weighed according to their estimated reliability. In a pre-design estimate for a process plant containing diverse types of equipment it will usually be found that many of the

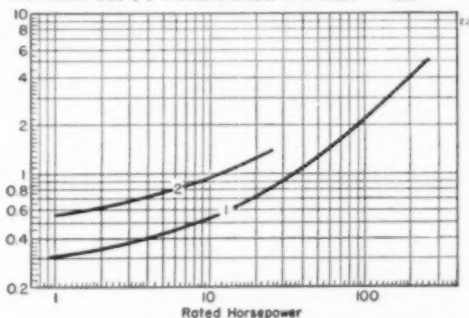
INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)



Demineralized Water Systems

Sources: P. Reliability: F.
Notes are on last page of article.

INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)

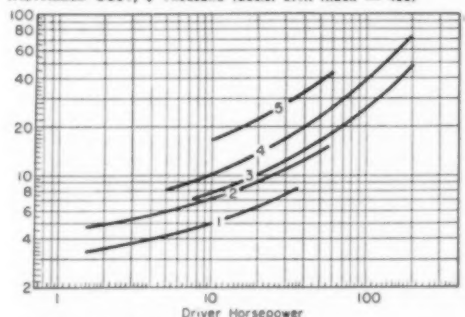


Electric Motors and Motoreducers¹

Curves	Description	Sources*	Reliability*
1	Electric motors	P, 20	G
2	Motoreducers	P	G

Notes are on last page of article.

INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)

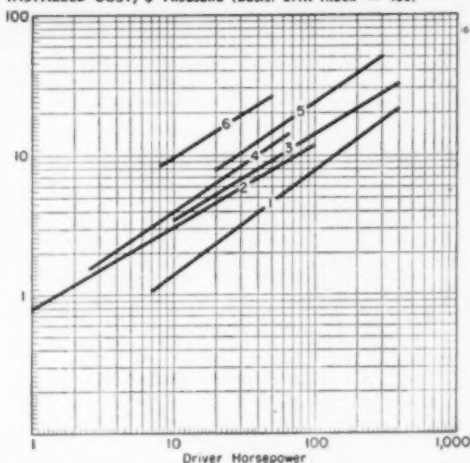


Centrifugals*

Curves	Description	Sources*	Reliability*
1	ATM suspended basket, steel	P, 14	F
2	ATM suspended basket, stainless	P, 14	F
3	Bird solid bowl, steel	P, 14	G
4	Bird solid bowl, stainless	P, 14	F
5	Sharples Super D, stainless	P	Q

Notes are on last page of article.

INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)

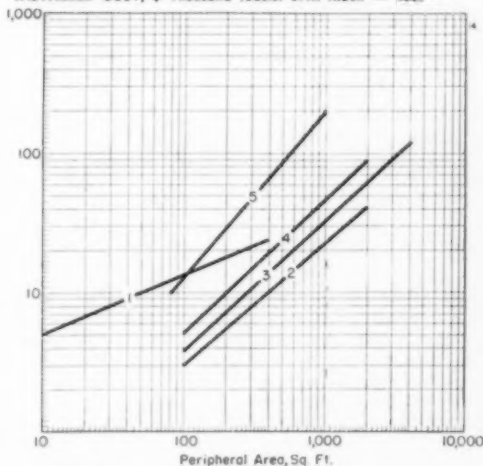


Size Reduction Equipment

Curves	Description	Sources*	Reliability*
1	Swing hammer mills	P, 9, 17	F
2	Jaw crushers	P, 9, 17, 27	F
3	Rotary crushers	P, 17, 27	F
4	Roll mills	P, 9, 17	F
5	Roll crushers	P, 9, 17, 27	G
6	Mikro-pulverizers	P	G
	Gyratory crushers	P, 17, 27	F
	Rotary cutters	P	E

Notes are on last page of article.

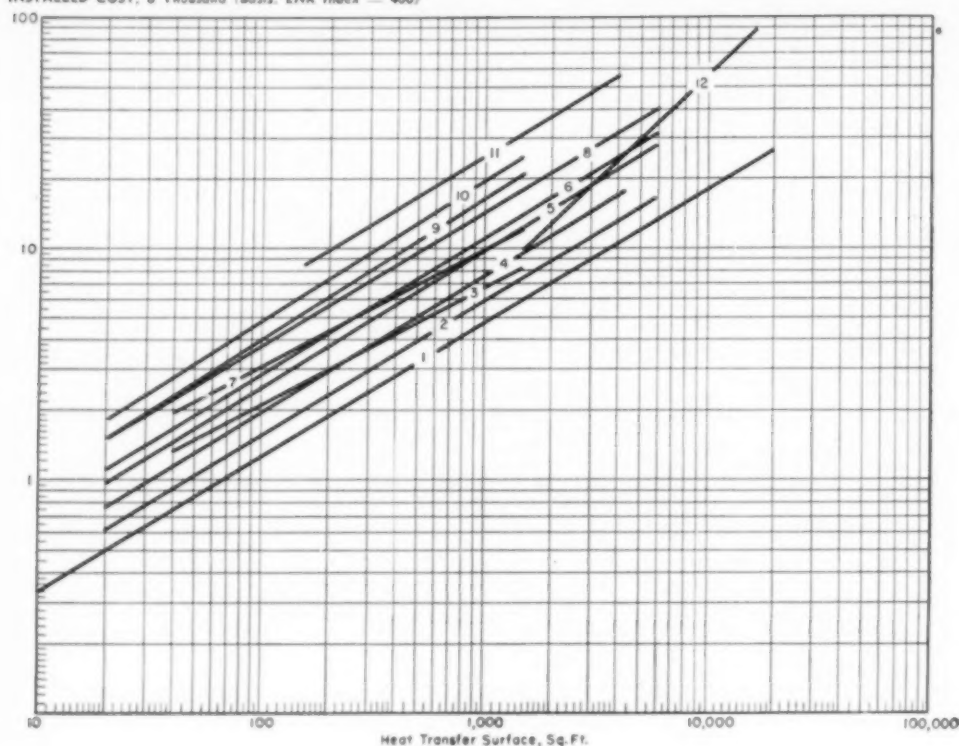
INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)



Dryers and Kilns

Curves	Description	Sources*	Reliability*
1	Drum dryers	P, 9	F
	Rotary dryers and kilns		
2	Hot air heated	9, 26, 27	F
3	Steel	P	Q
	Flue gas heated		
4	Direct	P, 9	G
5	Indirect	P, 9	F

Notes are on last page of article.



Heat Exchangers

Curve	Description	Source*	Reliability*	Curve	Description	Source*	Reliability*
1	Shell and tube exchangers			4	Shell and tube exchangers		
2	Steel shell	P, 20, 33	G	8	Steel shell	P, 20	G
3	Steel tubes	P, 20	G	9	Steel tubes	P, 20	G
4	Copper or brass tubes	P, 34	G	10	Stainless tubes	P	Q
5	Copper-nickel tubes	P, 20, 34	G	11	Jacketed pipe exchangers	P	Q
6	Stainless tubes			12	Stainless	P	Q
7	Stainless- clad shell				Glass-lined	P	Q
8	Stainless tubes				Drip coolers	P	Q
					Steel	P	Q
					Stainless	P	Q
					Waste heat boilers	P	Q

Notes are on last page of article.

EQUIPMENT COST DATA . . .

variations from the average will be compensating, so that the total cost figure will be of greater reliability than that of any of the component items.

Equipment cost data are presented in the form of graphs relating installed dollar cost to size or capacity, with distinctions made as to type of equipment and materials of construction.

The installed cost includes the basic equipment item plus installation labor, foundation or supports, installation of drive equipment and related auxiliaries, insulation, painting, and any piping considered an integral part of the equipment. Thus, for a liquid pump, the costs of base plate, drive, motor, starter, and wiring are included. Or for a direct fired rotary kiln, the costs

of drives, motors, and burner are included. Excluded from the installed costs as defined are connecting piping, instruments, building space, and the overhead costs of design and construction. Cost figures are corrected to a uniform Construction Cost Index of 400, as compiled by *Engineering News-Record* (1913 = 100). This basis was used not only for convenience, since much of the data corresponded closely to this particular index, but also because forecasts at the time this survey was begun predicted a leveling off at about 400 under more stable economic conditions. Prediction of the Index for a future construction job is still a very difficult, if not impossible, task.

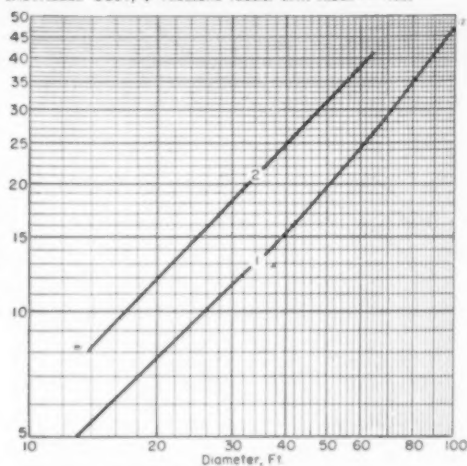
Sources of the data entering into each correlation are included in the

bibliography and shown in specific relation to each curve. We have also attempted to evaluate the reliability of each curve, based on the sources, volume, and internal agreement of the data.

TO GET TOTAL PLANT COST

Inasmuch as the installed cost of process equipment represents only a portion of the total project cost, a rapid method is needed for estimating the other costs involved. Final estimates, of course, figure these costs in the usual manner, from labor and material takeoffs based on the detailed plans. For pre-design estimates, a rough building and equipment layout can be made from which it is possible to figure approximate building sizes, extent of outside connecting

INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)

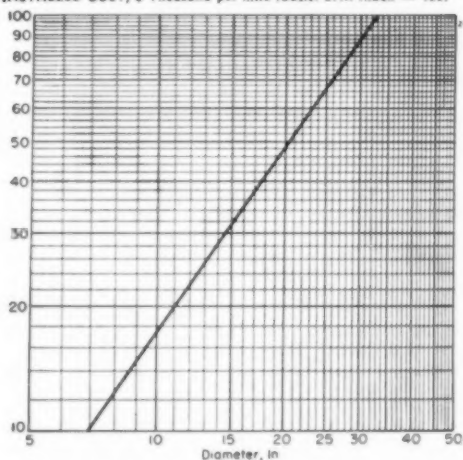


Continuous Thickeners

Curves	Description	Sources ^a	Reliability ^b
1	Single compartment	P, 31	F
2	Two compartment	P, 31	F

Notes are on last page of article.

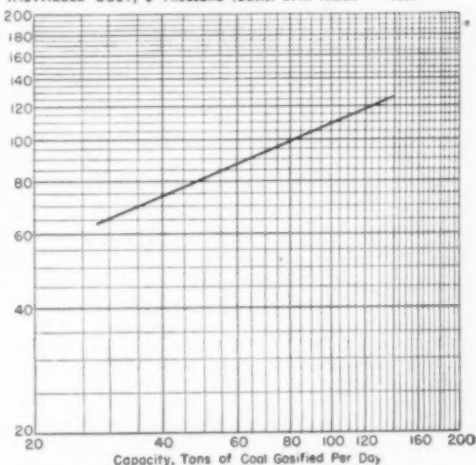
INSTALLED COST, \$ Thousand per mile (Basis: ENR Index = 400)



Cross-Country Pipelines^b

Includes pumping stations. Sources: 3, 4, 5, 25. Reliability: F. Notes are on last page of article.

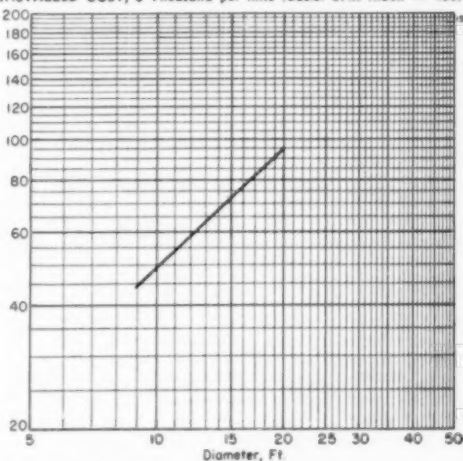
INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)



Gas Producers^a

Sources: 28. Reliability: F. Notes are on last page of article.

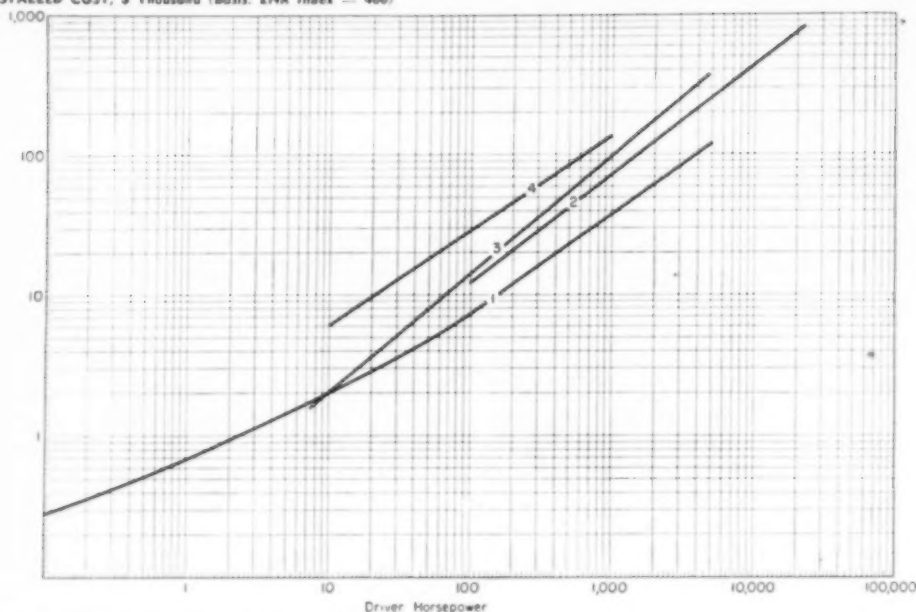
INSTALLED COST, \$ Thousand per mile (Basis: ENR Index = 400)



Spray Dryers

Description: Stainless steel. Source: 1. Reliability: F. Notes are on last page of article.

INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)



Fans, Blowers and Compressors

Curve	Description	Source ^a	Reliability ^b	Curve	Description	Source ^a	Reliability ^b
1	Fans and blowers.....	P, 20	G	3	Reciprocating comp., 1 & 2 stage....	P, 20, 34	G
2	Centrifugal compressors.....	P, 20	J	4	Reciprocating comp., multi-stage...	P	I

Notes are on last page of article.

EQUIPMENT COST DATA . . .

pipings, and other necessary service facilities. Inside process piping and instrumentation require greater detail, involving possibly more time than is available. It has been found possible, fortunately, to compute these costs as percentages of installed equipment costs with some degree of reliability. A good start at compilation of such factors was made by Lang,^(18, 20) who expressed his results as single over-all factors for projects involving installation of new facilities at an existing location, with distinctions made between solids, fluids, and mixed solids-fluids types of processes. Another set of factors for plants representing new facilities at a new location was presented by this same author at a recent meeting of the Philadelphia-Wilmington section of the AIChE.

The usefulness of arbitrary factors is open to some question. There is no chance for compensation of errors, and deviations from the assumed norm can introduce a considerable error into the final figure. Using Lang's data and other information from private sources and the literature,^(18, 21, 22) the writer has developed a system of factors which allows a greater exercise

of judgment and thus provides a wider range of usefulness. These factors are tabulated on page 106.

ABOUT THE INDEX

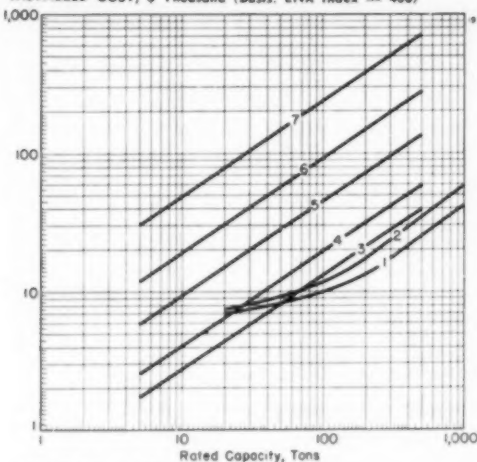
Various indexes have been used for relating construction costs to variations in the costs of material and labor. The most commonly used index is that compiled by Engineering News-Record from unit costs of certain types of steel, lumber, cement, and common labor. Although the synthesis of this index is obviously weighted in favor of building construction rather than chemical plant equipment and structures, it is used widely by many estimators for chemical plant construction. Other indexes may have a greater inherent accuracy for particular purposes and quite likely will gain in popularity. It matters little which index is used, as long as it is considered fairly reliable. It is necessary today to specify the value of the index upon which an estimate is based, or at least the month and year for which the cost figures are current. The ENR index has gone up rapidly over the past few years; starting with 1939 and ending with 1948 the yearly averages have been: 236, 242, 258, 276, 290, 299, 308, 346, 413, 461. It is beyond the

province of the engineer or estimator to attempt to extrapolate these indexes into the future; such crystal-ball gazing belongs to management.

CORROBORATES "SIX-TENTHS FACTOR"

Williams²³ has pointed out the validity of the "six-tenths factor" for approximating the cost of a piece of equipment or an entire plant when the cost of a similar unit of different size is known. In using this rule, the cost at the second size "x" times the first is got by multiplying the known cost by $x^{.6}$. In a graphical plot of cost versus capacity on logarithmic scales this rule would require a straight line with a slope of 0.6. The graphs presented in this article bear out this rule very well. It will be noted that the correlations for towers and thickeners give curves with slopes averaging about 1.2. Inasmuch as capacity of these items is a function of diameter squared, the six-tenths factor is still upheld. Similarly, the capacity of a rotary kiln may be taken as a function of the peripheral area to the 1.5 power, calling for a slope of 0.9, which is closely approximated in the graphical correlation. Greatest deviation is exhibited by high speed rotating equipment, such as pumps, fans, and centrif-

INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)

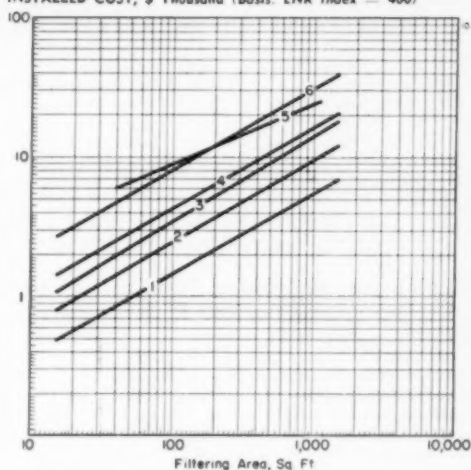


Refrigeration Units

Curves	Description	Sources*	Reliability†
1	Strain jet units		
2	+20°C	P	F
3	+10°C	P	F
4	Mechanical units		
5	+10°C	P, 2	F
6	0°C	P, 2	G
7	-20°C	P, 2	G
8	-10°C	P, 2	F
9	-60°C	P, 2	G

Notes are on last page of article.

INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)

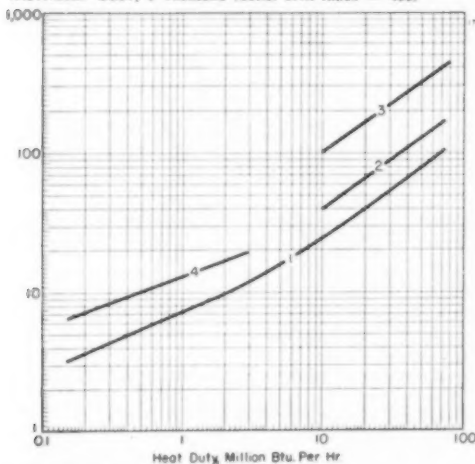


Liquid Filters

Curves	Description	Sources*	Reliability†
1	Filter presses		
2	Cast iron	P, 8, 32	F
3	Wood	P, 8, 32	F
4	Aluminum	8	Q
5	Lead	8	Q
6	Brass	8	Q
7	Stainless steel	8	Q
8	Pressure leaf filters		
9	2 in. spacing	P, 8, 32	G
10	4 in. spacing	P, 8, 32	G
11	Continuous vacuum filters	8, 32	F

Notes are on last page of article.

INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)

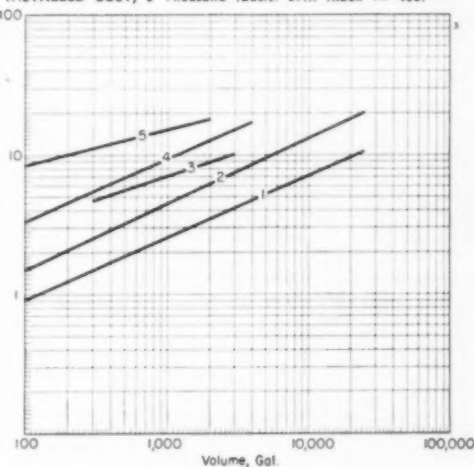


Furnaces

Curves	Description	Sources*	Reliability†
1	Tubular furnaces, steel tubes	P, 20	G
2	Cr steel tubes	P, 20	F
3	Cr-Ni steel tubes	P, 20	F
4	Dowtherm Units	P	F

Notes are on last page of article.

INSTALLED COST, \$ Thousand (Basis: ENR Index = 400)



Agitated Vessels

Curve	Description	Sources*	Reliability†
1	Agitated steel tanks	P	G
2	Agitated stainless tanks	P	G
3	Steel autoclaves	P, 8	Q
4	Glass-lined autoclaves	P, 8	Q
5	Stainless steel autoclaves	P	F

Notes are on last page of article.

EQUIPMENT COST DATA . . .

ugals. These curves show a lesser slope in the smaller sizes, passing through 0.6 slope in the intermediate range, to a higher slope for the larger sizes.

Data from the literature for various types of process plants also confirm this rule for complete plants.^{10, 11, 12, 13, 22, 23, 27, 30}

For those purposes where pre-design estimates are sufficiently accurate, therefore, the "six-tenths factor" can probably be applied to over-all plant

costs with some degree of confidence.

This will permit quick estimation of costs at various projected scales, as is so often desired in research and development studies. It should be borne in mind, however, that there is usually a maximum optimum size for plant installations, above which the cost-capacity curve will begin to approach a slope of 1.0. This maximum has probably been reached in the case of styrene plants and approached in that of CRS copolymer plants.

The writer acknowledges the kind

permission of the Du Pont Company Pigments Department to publish the graphed and tabulated data and of the Engineering Department to include data obtained from detailed estimates. Contributing substantially to the present work was an extensive compilation of data made by Roger Williams, Jr., while employed by Du Pont (he is now assistant editor of *Chemical Engineering*), and made available through the courtesy of F. J. Appel. Additional information was supplied by George W. Feldmann. To these our thanks.

Factors for estimating total-plant costs

■ Expressed as Percentages of Installed Process Equipment Cost

Process Piping = 7 to 60%

Low: Solids processing plants = 7 to 10%

Average: Mixed processing plants = 10 to 30%

High: Fluids processing plants = 30 to 60%

Instrumentation = 2 to 15%

Low: Little or no automatic controls = 2 to 5%

Average: Some automatic controls = 5 to 10%

High: Centralized complex control system = 10 to 15%

Manufacturing Buildings = 0 to 100%

Minimum: Installation in existing building = 0%

Low: Outdoor construction = 5 to 20%

Average: Mixed outdoor and indoor construction = 20 to 60%

High: Indoor construction = 60 to 100%

Auxiliary Facilities = 0 to 100%

Minimum: Existing facilities adequate = 0%

Low: Minor additions at existing site = 0 to 5%

Average: Major additions at existing site = 5 to 25%

High: Complete facilities at new site = 25 to 100%

"Process piping" refers to the pipe, valves, and fittings associated directly with the process equipment, including utility lines as well as lines carrying process materials. This portion of the piping is bounded by the area of the process building, even though the "building" may actually be an open framework structure or a group of storage tanks. Costs of service piping within the building area

but not associated with the process, such as steam for heating and sanitary and drinking water, are included in building costs. All piping external to the building area is classed as "outside lines," and costs include supports for overhead lines. Control valves and instrument air piping are included with instrumentation costs.

Building costs include service facilities such as heating, ventilation, sanitary

plumbing, lighting, and equipment supports where such supports are an integral part of the structure. Electrical facilities are not shown separately. Motors, starters, and wiring for process equipment are included in installed equipment costs. Electrical services within buildings are included with building costs. Outside feeder lines are included with costs of outside lines. Substation and transformer costs come under auxiliary facilities.

Outside Lines = 0 to 25%

Low: Close integration with existing facilities = 0 to 5%

Average: Separate processing units = 5 to 15%

High: Scattered processing units = 15 to 25%

■ Expressed as Percentages of Total Physical Cost

Engineering and Construction = 20 to 50%

Low: Straightforward engineering

Average labor/materials ratio } = 20 to 35%

High: Complex engineering

High labor/materials ratio } = 35 to 50%

Contingencies = 10 to 50%

Low: Firm process = 10 to 20%

Average: Subject to change = 20 to 30%

High: Speculative process = 30 to 50%

Size Factor = 0 to 35%

Low: Large commercial unit = 0 to 5%

Average: Small commercial unit = 5 to 15%

High: Experimental unit = 15 to 35%

Notes on graphs

A. P means data came from private or unpublished sources.

Numbers refer to literature references below.

B. G, good, consistent data from several sources. F, fair, data from limited sources, internal agreement somewhat scattered.

Q, questionable, data limited in scope and from limited sources, poor internal agreement.

C. For pressures in 100-300 psi. range. For higher pressures other estimating methods are required.

D. "Autoclave" here designates a jacketed reaction vessel with moderate agitation for pressures not exceeding 100 psi. For higher pressures or vigorous agitation other estimating methods are required.

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Fluorocarbon Background

Here's some information on a group of chemicals that will become industrially important

J. H. Simons

Fluorocarbons are destined to become a new domain in chemistry. As their name indicates, they are compounds of carbon and fluorine. But more generally they represent compounds of carbon analogous to those usually classified as hydrocarbons in which fluorine instead of hydrogen is attached to the carbon. Chemically, however, the properties of these compounds are so vastly different that they offer many varied and entirely new fields of utilization.

It would be a tremendous blessing to society to be able to furnish mankind with adequate and suitable materials of construction with properties analogous to those of substances now being used, but which do not have their undesirable fire hazard. The fluorocarbons and their derivatives seem destined to fulfill this role. It has already been shown that not only can carbonaceous structures of great variety be prepared but also that, in addition to having greater stability toward heat and chemical reaction than the analogous hydrocarbon compounds, they are so resistant to combustion that they not only resist being set on fire but will block or smother fire already started.

The fluorocarbons were first prepared by a chemical reaction between carbon and gaseous fluorine similar to the preparation of carbon monoxide and carbon dioxide from the burning coal. At first only those compounds containing a very small number of carbon atoms in the molecule were obtained, and the reaction was found to be somewhat hazardous due to explosions. Later at Penn State this reaction was controlled by means of suitable catalysts and a considerable amount of liquid product obtained.

At the beginning of World War II there were desired for certain important military uses, such as in the separation of the uranium isotopes, chemical substances of the type of materials of construction that were extremely inert chemically. The fluoro-

carbons were recommended for this use. A number of very interesting processes were developed and put into large-scale use. Unfortunately, these require either the employment of gaseous fluorine on a large scale or elaborate, tedious, and expensive series of difficult chemical reactions.

It has recently been disclosed that fluorocarbons and certain of their derivatives can be made directly from organic chemical substances and hydrogen fluoride in a one-step electrochemical process carried out at low temperature. The process does not produce or employ elementary fluorine.

The essential unit in the electrochemical process for the production of fluorocarbons is an electrochemical cell. This is of relatively simple design, being an iron vessel in which are placed the necessary nickel electrode sheets. Diaphragms are unnecessary as the hydrogen and the fluorocarbons do not react together. This enables many electrodes to be placed within the volume of the cell, making for a very high volume efficiency.

In large-scale operation, this cell is first filled with liquid hydrogen fluoride and an amount of the desired organic chemical raw material necessary to produce a solution of the desired concentration.

During electrolysis hydrogen is evolved which keeps the solution vigorously agitated. The escaping gas carries with it a certain amount of hydrogen fluoride and any volatile fluorocarbon products that may be produced. Auxiliary equipment condenses and returns the hydrogen fluoride to the cell and removes the desired fluorocarbon products. Liquid products formed are more dense than the cell solution and are drained off from the bottom of the cell. In continuous operation the hydrogen fluoride and organic chemical raw material are continuously pumped into the cell as the products are continuously removed.

A surprisingly large number of different types of raw material have already been found suitable for use in this process. Organic chemical substances in general can be employed. Many are soluble to a very considerable extent in hydrogen fluoride and

form conducting solutions. This is true of oxygen-containing acids, alcohols and ethers; nitrogen-containing amines, nitriles; and other organic chemical compounds containing functional groups which enable ions to be produced in hydrogen fluoride solution. The process is not restricted to such soluble and ion-producing organic compounds. Even those which are sparingly soluble and which do not form highly conducting solutions may be employed by using a third substance, organic or inorganic, which can supply ions to the solution so as to enable the current to be carried. Hydrocarbons, such as those found in petroleum, come in this latter class and can be employed as inexpensive raw materials for the production of fluorocarbons having the same number of carbon atoms as the original hydrocarbons and arranged in the same structure.

Fluorocarbons of a great variety of structures have already been produced by this process. They range from substances which are gases at ordinary temperature to materials of relatively high boiling points. The carbon atoms can be arranged in linear chains, in branch structures, in cyclic arrangements, and in combination of the foregoing. In addition to the fluorocarbons, compounds are also made in which the major constituents are carbon and fluorine, but in which there are minor constituents such as hydrogen, oxygen, chlorine, etc. The production of fluorocarbons containing these other elements greatly increases the number of types of substances produced and thus increases the range of possible uses of fluorocarbon compounds.

In addition to products containing only carbon and fluorine, with perhaps minor amounts of other elements, the fluorocarbons may also, by means of reactions of the functional groups, be combined with hydrocarbon materials to produce substances which are part hydrocarbon and part fluorocarbon, and with properties intermediate between the two extremes.

All the above could be true and still the fluorocarbons not be available for general use unless the process or processes for their preparation were sufficiently simple and inexpensive so that they could be made in sufficient quantity. Studies of the new electrochemical process to date indicate that not only can it produce fluorocarbon substances in great variety from a great variety of raw materials but also that it can do this at a relatively low cost, and that it is a process which is imminently suitable for large-scale use.

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Pneumatic Feeder For Finely Divided Solids

During experimental work on coal gasification, the Bureau of Mines developed this device for uniform feeding of pulverized coal to a reactor. It should work with any finely divided solid.

C. W. ALBRIGHT, J. H. HOLDEN
H. P. SIMONS, L. D. SCHMIDT

In the course of development work on the gasification of pulverized coal by the Bureau of Mines at Morgantown, W. Va., a mechanism to feed finely pulverized coal to a reactor became necessary. The feeder described in this article was developed to fill that need, but it should be applicable to the feeding of any finely divided solid.

In the gasification of pulverized coal in entrainment, the total residence time of a coal particle in the gasifying zone is probably, at most, about a second; hence, if the coal feed varies over even fractions of a second, both the ratio of coal to gasifying agents and the gas composition will vary widely, resulting in poor operation. Although averaging a steady rate, mechanical feeders are inherently unsteady over short time intervals. Screw feeders, for example, feed at varying rates during a single revolution. Most mechanical feeders de-aerate or compact the coal, with a resultant tendency for the coal to feed in slugs. Another difficulty common to feeding

devices for pulverized coal is sensitivity to pressure. That is, if the back pressure varies, the rate of coal feeding varies, setting up a vicious cycle of fluctuations.

Extensive development of systems for handling pulverized coal under pressure has been conducted by the Locomotive Development Committee of Bituminous Coal Research, Inc. It is reported (Yellott, J. I., and Kottcamp, C. F., *Coal-Fired Turbine Power Plant*, ASME, June 1947) that its pressurized combustor is fed by a coal-air stream having a weight ratio of coal to air of about 3:1. Control of the coal rate is attained by passing a fraction of the coal-air mixture through a cyclone; the separated coal is returned to the storage tank. Uniformity of the coal-air mixture is improved by incorporating an atomizer or pneumatic coal pulverizer in the line carrying the coal-air mixture and removing sensitivity to pressure by passing the coal-air mixture through a critical flow orifice. In pulverized-coal gasification in steam and oxygen, these techniques are considered undesirable. Furthermore, it was preferable to avoid the use of both steam and oxygen as the conveying gas; therefore, an inert gas was necessary as a conveying medium. In order not to contaminate the make gas with the conveying gas, as well as not to take heat from the process, the quantity of conveying gas must be kept to a minimum.

Pulverized coal, when flowing by gravity, often sticks to the walls of the container and arches over the opening. When kept moving slightly by a

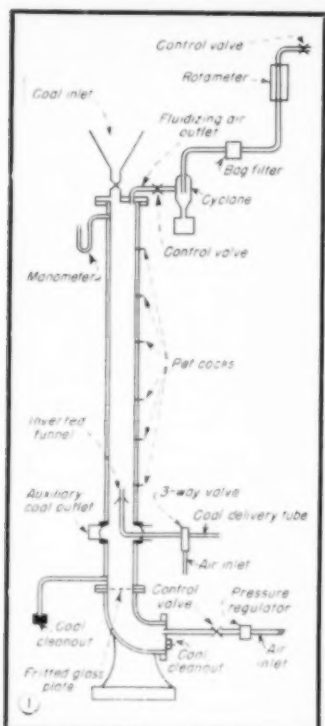
gas, however, pulverized coal flows easily, even through small-diameter tubes. To utilize this property of pulverized coal, the feeder described herein consists of a fluidized bed in which the coal is kept agitated, a fluidizing air outlet, and a coal-delivery tube. The coal and the conveying gas flow through the coal-delivery tube from the fluidized bed to the reactor, while the fluidizing air used is vented from the top of the fluidization chamber.

OPERATION OF APPARATUS

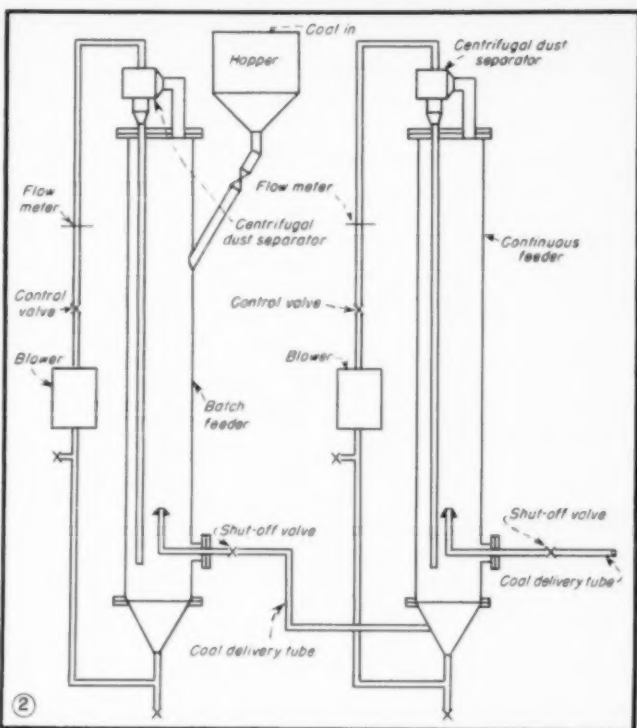
A diagram of the experimental apparatus is shown in Fig. 1. A 4-in., Schedule 40 pipe, 5 ft. long, is used as the fluidization chamber. Coal is charged into the apparatus until it is about one-half full. Air enters at the bottom, is distributed by the fritted-glass plate, and fluidizes the coal. The coal then fills about two-thirds of the pipe; the level may be checked by the petcocks. The fluidization air is adjusted to the desired rate, as measured by the rotameter. The coal line is blown out by admitting air through the three-way valve, and the coal flow is started by turning the valve to the straight-through position. The operation is steady and the mixture of coal and air uniform. Weight ratios of coal to air of about 200:1 are regularly passed through the coal-delivery tube. No additional air is added to the coal-delivery tube for conveying.

Fluidization of the coal in the 4-in. pipe is not completely uniform. The object of the inverted funnel at the coal inlet is to prevent large air bubbles from entering the coal-delivery

This pneumatic feeder is a cooperative development of the Bureau of Mines and West Virginia University. C. W. ALBRIGHT is a graduate student and H. P. SIMONS is professor of chemical engineering at the University. J. H. HOLDEN and L. D. SCHMIDT are, respectively, chemical engineer and chief of the Synthesis Gas Production Branch of the Bureau of Mines' Office of Synthetic Liquid Fuels. All are at Morgantown, W. Va.



BATCH feeding was used in the first experimental apparatus, diagrammed above.



CONTINUOUS method, obtained by feeding coal from a batch feeder to fluidization chamber of Fig. 1, permits uninterrupted operation during recharging.

tube. When no provision is made to exclude these bubbles, the flow of coal is interrupted by slugs of air. The original position of the funnel was the reverse of that shown in Fig. 1, thereby providing an enlarged entrance to the coal-delivery tube. Some settling-out effect was then obtained in the funnel so that the coal:air ratio increased. By this means, coal:air weight ratios as high as 400:1 have been sent through the coal-delivery tube. However, the ratio of coal to air was not as easily controlled as it was in the arrangement in Fig. 1 since it was more a function of the settling-out time than of the fluidization rate. The position of the inlet in the bed is also important and must be fixed if consistent results are to be obtained because the coal:air ratio increases as the inlet approaches the wall.

The rate of flow of fluidizing air is an important operating variable. If the fluidization rate is too low, the coal flow through the delivery tube becomes erratic, and the ratio of coal to air flowing through the tube be-

comes a variable. On increasing the fluidization rate, however, the flow becomes steady. Some coals require a higher fluidization rate than others because of a packing tendency.

Dust carry-over in the fluidizing air outlet clogs the line unless enough disengaging space is provided at the top of the fluidizing chamber. With a disengaging space of about 2 ft., the arrangement shown in Fig. 1 was satisfactory.

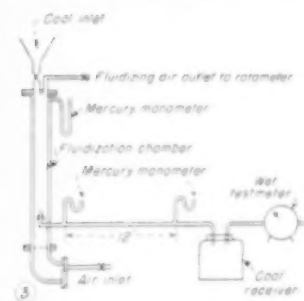
There is some variation in the static pressure at the entrance to the coal-delivery tube in the fluidization chamber during a run because of the change in level of the coal. With a 12-ft. length of 3-mm. I.D. tubing serving as the coal-delivery tube, the back pressure is such that maximum variation in depth of fluidized bed caused only a 10 percent change in the static pressure at the coal-delivery-tube level. Since the equipment maintains a constant pressure at the top of the coal bed, the change in pressure due to the change in depth of the coal bed may be offset by gradually increasing the

air pressure over the coal during the run. By feeding coal continuously into the apparatus, this change in pressure may be further minimized.

Fig. 2 shows one arrangement for making the equipment continuous. Coal is fed to the fluidization chamber of Fig. 1 from a second feeder, which is operated as a batch feeder. The continuous feeder is operated at a constant coal level in the fluidization chamber except when the batch feeder is stopped for charging. The continuous feeder has enough capacity to continue operating while the batch feeder is being charged. After the batch feeder has been charged, the coal level in the continuous feeder is restored to its original position and steady operation resumed. In this arrangement, the equipment is operated without the necessity of shutting down for recharging, and the pressure drop through the coal-delivery tube may be kept constant. In all other respects, the operation is the same as that of the original equipment.

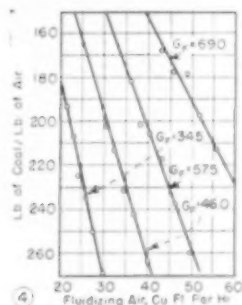
Test runs were made to learn the

Test Set-Up

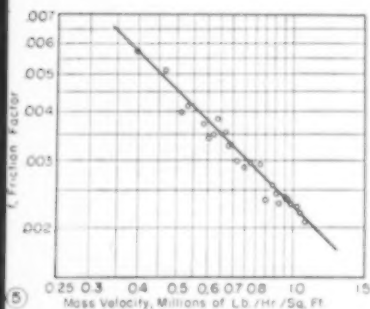


Test runs were made to find out operating action of feeder and fluid-flow properties of coal-air mixtures at the new high ratios.

Test Results



Volumetric rate of air flow vs. weight ratio of coal to air. Each line is a constant weight rate of air flow.



Friction factor vs. mass velocity. The negative slope through the experimental points indicates viscous flow prevails.

operating characteristics of this new feeder and also to obtain data on fluid-flow properties of coal-air mixtures at the new extremely high coal:air ratios made possible by this feeder.

OPERATING RESULTS

Fig. 3 shows the arrangement used in the test runs. The fluidization chamber of Fig. 1 was connected with a 12-ft. length of 3-mm. I.D. copper tubing for a coal-delivery tube. The coal was collected in a jar and weighed on scales. The separation of coal and air in the jar was surprisingly complete; only a slight amount of dust was carried over. At the more usual conveying ratios of 5 lb. of coal per lb. of air, the separation of coal and air would have required the use of cyclones or bag filters. The extremely dense phase used in this equipment flows much like water, and the coal does not entrain easily in air. The volumetric rate of flow of conveying gas was measured by the wet test gas meter shown in Fig. 3.

Figs. 4 and 5 show the data obtained. Fig. 4 is a plot of the volumetric rate of flow of fluidizing air at the column pressure against the weight ratio of coal to air flowing through the coal delivery tube. Each line is drawn for a constant weight rate of flow of fluidizing air. The lines are drawn to pass through the origin, and the slope of the lines is a function of the weight rate of flow of fluidizing air. The data have been correlated by the empirical equation,

$$y = 357 \frac{G_p}{p'} (10^{-6} - 0.0001 p') \quad (1)$$

where y = weight ratio of coal to air flowing through the coal delivery tube, no units, G_p = mass velocity of fluidizing air vented from the top of the column, (lb.)/(hr.) (sq. ft. of empty column), and p' = absolute pressure in the fluidizing column, psi. The data may also be correlated by the empirical equation $y = (5,570 - 6,760V)/p'$ V = linear velocity of fluidization air through empty column, fps.

Fig. 5 is a plot of the friction factor against G , the mass velocity in pounds of coal and air per hour per square foot flowing through the coal-delivery tube. The value of the friction factor is calculated from the equation:

$$\frac{RT}{M} \ln \frac{p_1}{p_2} + \frac{y}{p_2} (p_1 - p_2) = \frac{1 + y}{2g} \left(w_1^2 - w_2^2 + \frac{4fLw_1^3}{D} \right) \quad (2)$$

where D = tube diameter, ft., f = friction factor, no units, g = gravitational constant, ft./sec², L = length between pressure taps, ft., M = molecular weight of conveying gas, lb.,

Screen Analysis of Coal Used

Tyler Standard Screen	Cumulative Wt. % Retained
60	0
70	0.3
100	1.7
150	4.7
200	10.5
300	83.2
325	85.2

p_1, p_2 = pressure at first and second taps respectively, lb./sq. ft., R = gas constant, ft.-lb./°R., T = temperature °R., w_1, w_2 = velocity of the coal air mixture at the first tap, at the second tap, and the average respectively, ft./sec., v_1, v_2 = specific volume of air and coal respectively, cu. ft./lb., y = lb. of coal per lb. of air, no units, p_s = true coal density, taken as 84 lb./cu. ft. This equation is derived from the mechanical energy balance

$$wdp + \frac{wdu}{g} + \frac{2fwDL}{gD} = 0$$

The derivation is given on p. 111.

DISCUSSION OF RESULTS

The line drawn through the experimental points of Fig. 5 has a slope of -1 , indicating that viscous flow prevails. Using the relation $f = 16/Re$, (Perry, J. H., Chem. Eng. Handbook: 2d ed., McGraw-Hill Book Co., New York, p. 800, 1941) the Reynolds number is calculated as 3,000 to 7,000. This range is considerably above the usual transition range of viscous to turbulent flow. However, Leva, and others (Max Leva, Milton Grummer, Murray Weintraub and Morris Polchik, Chem. Eng. Progress, 44, 511-522, 1948) found that viscous flow prevails in fluidized beds. Because of the small-diameter, smooth tube used in these experimental runs, viscous flow prevailed beyond the usual transition range. It is possible that in a rough pipe of larger diameter, turbulent flow would obtain at these Reynolds numbers. Another reason for viscous flow is that the coal particles are not free to move about as are the particles of a gas or liquid. The high concentration of coal particles prevents sideward motion, resulting in enforced streamline flow. If this is the case, the transition to turbulent flow would occur at a much higher value of the Reynolds number than in the flow of a gas or liquid.

From the Reynolds number, obtained from the relation $f = 16/Re$, the viscosity of the coal-air mixture has been calculated as 0.6 centipoise. It is probable that the viscosity of the coal-air mixture varies with the volume ratio of coal to air in the mixture. If so, the experimental values of f plotted in Fig. 5 may be drawn together into a better line when plotted

against the Reynolds number. An attempt was made to measure the viscosity of a dense mixture of coal and air, using a Stormer viscosimeter. Considerable difficulty was encountered in operating the instrument under these conditions, and the accuracy of the measurement was low. However, the measurement indicated that the viscosity of the mixture was of the same order of magnitude as that estimated assuming viscous flow.

The mixture of coal and air withdrawn from the fluidized bed cannot be regarded as a true measure of the average density of the bed. It was found that the weight ratio of coal to air was increased when the coal-inlet tube approached the wall. Use could be made of this fact to vary the coal air ratio by having several outlets at various positions across a diameter of the column. The empirical relation for the weight ratio of coal to air reported in this article will apply only for the position of the coal inlet used. While an attempt was made to center the coal inlet in the column, its exact location is unknown.

In order to calculate the pressure drop for dense-phase flow, Eq. 2 may be used, and the friction factor used from the usual plot of Re against f . The viscosity, however, must be found for the mixture of gas and solid flowing. For mixtures of coal and air at room temperature, the viscosity is about 0.6 centipoise for weight ratios of about 200:1.

For the flow of coal-air mixtures at weight ratios of about 3:1, the friction factor has been found to agree with the usual values if the Reynolds number is calculated using the density of the coal-air mixture rather than that for air alone (Yellott, J. I., and Kottcamp, C. F., *The Coal-Fired Turbine Power Plant*, ASME, June 1947.) At these relatively low coal to air ratios, the viscosity substantially equals that of air alone, whereas at the high ratios used in the pneumatic feeder, the viscosity is increased to about 30 times that of air alone.

FLUID-CATALYST TECHNIQUE

The fluid-catalyst process distinguishes between the two types of flow occurring in the process, that is, "dense-phase" and "dilute-phase" flow. Bed densities are given (Daniels, L. S., *Petroleum Refiner*, 25, 109, Sept., 1946) as approximately 25 to 30 lb. per cu. ft. and the true particle density as 130 lb. per cu. ft. The mixture of solid and gas flowing out of the bed is called the "dense phase" and, from the densities given, has a volume percent solid of about 21. The bed density used in the pneumatic feeder

during the test runs was about 16 lb. per cu. ft.; the true particle density, 84 lb. per cu. ft.; and the volume percent solid, about 19. Therefore, the pneumatic feeder operated at about the same volumetric ratio of solid to gas that, in the fluid-catalyst process, is called the "dense phase." Engineers working on the fluid-catalyst process report unsteady flow at low velocities (less than 2 fps.). The same result was obtained with the pneumatic feeder, flow becoming erratic and difficult to control at low velocities. Dense-phase design velocities of 5 to 7 fps. are reported (Daniels, L. S., *Petroleum Refiner*, 25, 109, Sept., 1946) for the fluid-catalyst processes. The velocities used in the coal-delivery tube of the pneumatic feeder were about 5 to 15 fps.

The dilute-phase flow has a much lower ratio of solid to gas and requires a higher velocity for steady flow. The dilute-phase flow is similar to ordinary conveying practice where 5 lb. of coal per lb. of air is often used. In this type of flow, the carrier gas moves at a higher velocity than the solid, whereas, in dense-phase flow, the solid and gas seem to move together without any slip.

ADVANTAGES OF FEEDER

The feeder produces a steady flow of coal in a solid stream at coal:air weight ratios of about 200:1. Previous practice in coal conveying used ratios of less than 5 lb. of coal per lb. of air. Since the coal from the pneumatic feeder flows in a settled state, low velocities in the range of 5 to 10 fps. may be used in the coal-delivery tube without having the coal settle out. Using coal:air ratios of about 5:1, velocities of 50 to 100 fps. are necessary to keep the coal from settling out. Using the pneumatic feeder to convey 6 tons of pulverized coal per hour through a 2-in. pipe 1,000 ft. long at a velocity of 10 fps., the horsepower required is about 100. Two hundred and fifty horsepower is required (Hudson, W. G., *Conveyors and Related Equipment*: John Wiley & Sons, New York, p. 114-128, 1946) to convey 6 tons of pulverized coal per hour using a 4-in. pipe 1,000 ft. long, a velocity of 75 fps. and a coal:air weight ratio of 5:1.

The main contribution of the feeder, however, is that it is now possible to charge finely divided solids to an apparatus at a controlled, uniform rate, with low contamination due to carrier gas. In a heterogeneous reaction requiring a controlled rate of feeding of finely divided solids, the pneumatic feeder presents an easy method of introducing the powder, regardless of

the pressure required in the reactor. The feeder itself has no moving parts, thus minimizing wear.

Mechanical feeders for pressure vessels present many unsolved problems; for example, packing-gland troubles caused by leaking or by freezing of moving shafts. These difficulties are avoided with the pneumatic feeder. The operating characteristics of the feeder and the fluid-flow properties of the dense phase are being investigated at high pressures. In pulverized-coal gasification, introduction of the coal into the generator has always been a major operational problem. (Atwell, H. V., *Koppers Powdered Coal Gasification Process*: FIAT Report 1303, and Atwell, H. V., *Gunz Powdered Coal Gasification Process*: FIAT Report 1304, Joint Intelligence Objectives Agency, Washington, D. C., Sept., 1947.)

In using the feeder on a larger scale, it may be arranged in several ways. The powder may be blown into the fluidized bed in the dilute phase; and, by entering at the bottom, the carrier gas will serve as fluidizing gas. The feeder then concentrates the solid in the gas stream and removes the fluctuations in the feed rate. If enough capacity is provided in the feeder, the dilute-phase flow to the feeder may be discontinuous. A feeder may also be made continuous by having a mechanical charging device. The feeder promises to solve many problems whose solution previously has been difficult.

DERIVATION OF EQ. 2

The mechanical energy balance is written separately for 1 lb. of air and v lb. of coal as follows (Perry, J. H., *Chem. Eng. Handbook*: 2d ed., McGraw-Hill Book Co., New York, p. S07, 1941):

$$v_s dp + \frac{v du}{g} + \frac{2f v^2 dL}{gD} = 0,$$

and

$$v_s dy + y \frac{v du}{g} + y \frac{2f v^2 dL}{gD} = 0$$

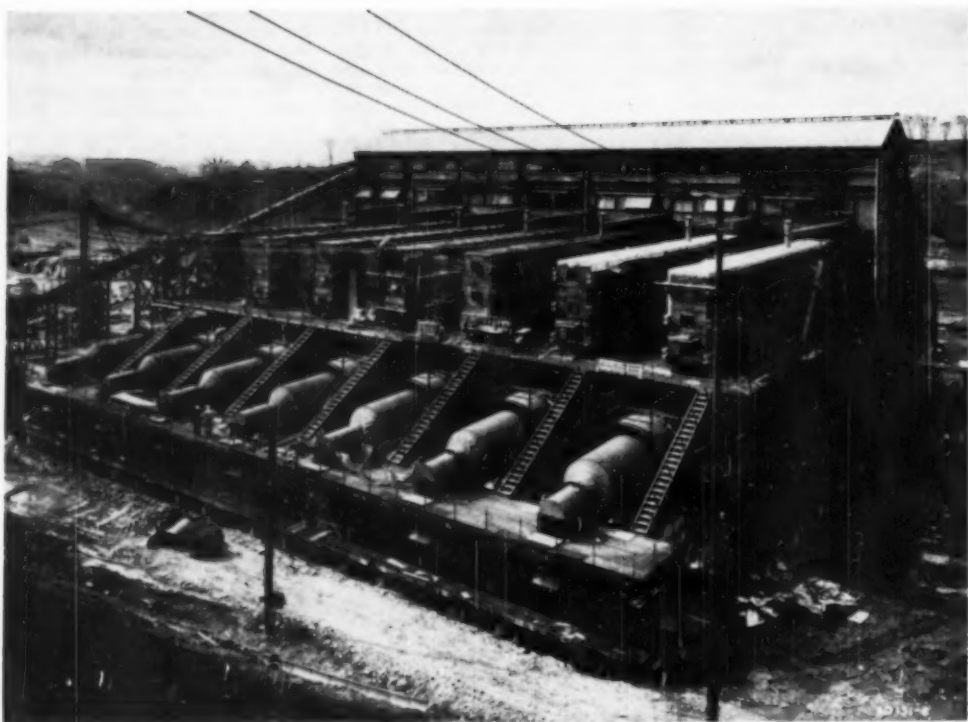
Assuming no slip, the velocity of the coal and air is equal. The equations may be added to give

$$(v_s + v_s) dp + (1 + y) \frac{v du}{g} + (1 + y) \frac{2f v^2 dL}{gD} = 0$$

Neglecting the change of velocity in the friction term, the equation may be rearranged to

$$\frac{RT}{\rho M} dp + \frac{y}{\rho c} dp + (1 + y) \frac{v du}{g} + (1 + y) \frac{2f v^2 dL}{gD} = 0$$

where u_s is the average velocity of the coal and air flowing through the tube. Integrating, the equation becomes Eq. 2.



DISCO PLANT. Daily capacity is 800 tons of coke, produced from 1,000 tons of bituminous fines. Coke sells for 2-2½ times as much as the fines—a good job of upgrading. Disco Co. is offspring of Pittsburgh Consolidation Coal Co.

Low-Temperature Coking Plant

The road to low-temperature carbonization of coal is strewn with schemes that tried and failed. Now comes one that looks like it will work. At least it's getting a \$3 million trial.

R. S. McBRIDE

Low-temperature carbonization of coal makes an outstanding advance in the new plant of the Disco Co., a plant based on research which began in 1928. This new installation, designed to process more than 1,000 tons coal per day, proves a success in striking contrast with the general failure which has been experienced by many companies who previously attempted

R. S. McBRIDE is an editorial representative for Chemical Engineering in Washington, D. C.

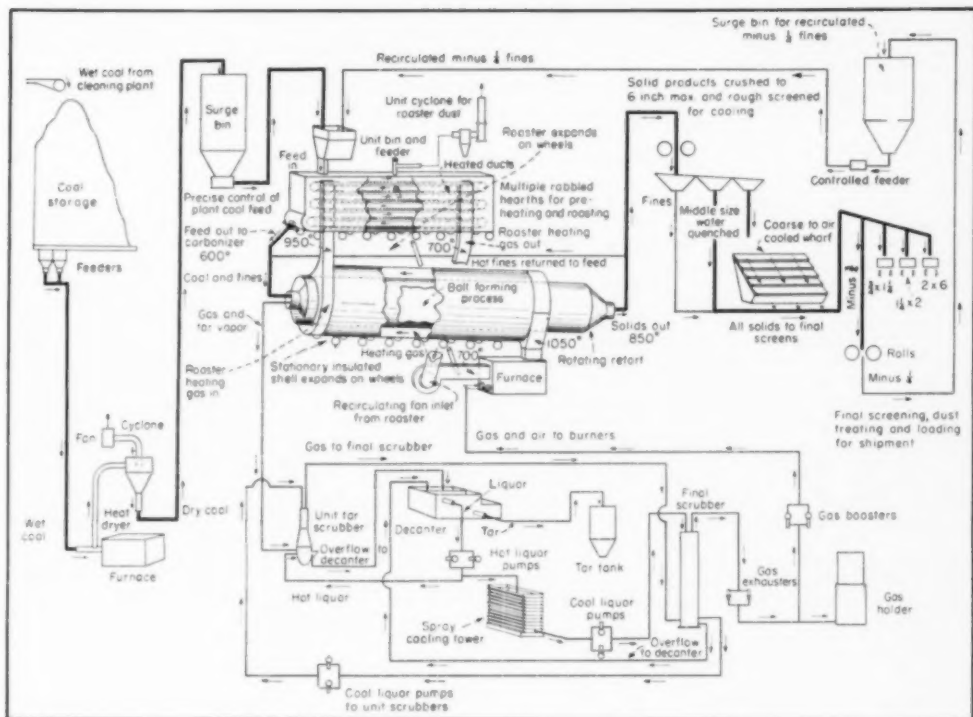
low-temperature carbonization. The plant is also the first commercial fruit of long investigation and of engineering development in which the company has operated three experimental retorts of full commercial size for several years.

The new \$3,000,000 plant has begun operation for the manufacture of smokeless solid fuel with chemical byproduct recovery in a seven-retort installation recently completed near McDonald, Pa., near Pittsburgh. This plant involves numerous engineering improvements over the developmental units, the first of which has been op-

erating almost continuously since 1933; but it uses the same basic process which has proved to have both technologic merit and profit making opportunity.

With one possible exception, this is the first case in which an industrial management has carried through to such complete technical and economic promise a true low-temperature carbonization process. Recent experience in the development plant has proved on a scale of 7,000 tons of smokeless fuel monthly that this is not a merely academic undertaking.

Management confidence, which



DISCO PROCESS. Bituminous fines are dried, roasted and dropped into rotating retort. Here volatiles are driven off, coke is tumbled into balls. Balls are cooled and sized for shipment. Plant recovers tar and gas, but not light oil.

seems amply justified, is well expressed by Pres. Carl E. Leshner in his announcement: "The decision to build a large scale commercial coal conversion plant—the first in this country to utilize a low-temperature process—with capacity to consume more than 1,000 tons of high-volatile coal daily, and producing 800 daily tons of Disco, is another result of the recent merger that formed Pittsburgh Consolidation Coal Company. Several factors buttress our confidence that this large commercial low temperature coke plant will be the forerunner of others that will be built in coal consuming areas throughout the country."

SOLID FUEL PRODUCT

The solid fuel produced, which is marketed under the trade name Disco, consists of balls of lightly carbonized product which affords splendid smokeless fuel service in house heating and other small stoves and furnaces. The liquid product of carbonization is a tar which has been refined to produce tar acid oil, tar acids, creosote, fuel pitch, and pitch coke. The gas pro-

duced during coking, after removal of the crude liquid products, is used for firing of the retort.

The new installation is located adjacent to one of the large coal washeries of the parent company, Pittsburgh Consolidated Coal Co. Its major objective is the production of clean washed sized coal ranging from large lump to the fines.

EFFECT OF SIZE ON PRICE

Naturally the market price obtainable for the fines, that is the cleaned coal which is through 1-in. square-mesh screen, is lower than for the larger sizes. The economic advantage of using the fines in a carbonization plant is great. A ton of this coal makes approximately three-quarters of a ton of coke, which at this shipping point is worth from two to two and a half times as much per ton as the raw material from which it comes.

During the past 15 years of manufacture, there has been little difficulty in selling the coke to householders.

The cleaned fines are conveyed from the washery by belt to the stockpile

which provides storage for a month's supply closely adjoining the new plant. This coal is reclaimed from the stockpile by a bulldozer pushing it into a conveyor pit.

BEGINNING OF PROCESS

The process proper begins with this wet coal and includes the following steps: (a) predrying, (b) "roasting," (c) carbonizing in retorts, (d) cooling and (e) screening and loading. Gas and tar are recovered as byproducts.

The drying equipment lowers the moisture content to the desired 2 to 3 percent in three flash dryers heated by the hot blue gas from a coal-fired furnace below. From cyclone collectors at the top of each dryer unit the dry coal is carried by belt conveyor to the carbonizer building.

A vital step in the process is the modification and control of coking characteristics of the coal by a treatment which is called "roasting." This process preheats the coal and partially oxidizes it by exposure to controlled quantities of air in six-pass rectangular hearth roasters. The hearths are

heated by circulating flue gas in heating ducts not in contact with coal. It is essential that the feed to the roasters be closely controlled in order to insure uniform performance. Rabbits move the coal the length of the roasters in continuous streams for six passes in alternate direction. The last two passes are like the four above except that some coal is re-cycled around this final loop in order that uniformity of quantity and quality of the feed from the roaster into the carbonizing retort may be maintained very exactly.

Air control is manually maintained in the heating ducts of the roasters so that coal reaching the last pass is correctly and uniformly prepared for retorting. The coal from the last pass is fed to the retort by a rotary-feed device at 600 deg. F.

PRETREATMENT CONTROL

The purpose of preheating and roasting is to control the excessive caking characteristic of this high-grade bituminous coal. Close control of the pretreatment is essential, in order to secure uniform size and strength and a satisfactory stove or furnace performance of the product made in the retort. It is at this key point that the company has achieved a result which gives success, where most other low-temperature coking systems have failed.

The carbonizing retort proper is a rotating cylindrical 4-in. steel shell approximately 9 ft. diameter by 126 ft. in length, inside dimensions. It is mounted inside of an insulated stationary steel cylinder. The inner shell, which is unlined, is mounted almost horizontally, but with a slight slope so that it may rotate like a typical cement or lime kiln. Heating is from the outside by high-speed flue gas in the annulus between the outer stationary shell and the revolving retort. The heating gas is retained at the two ends by rubbing strips which are attached to the outer shell and ride on the rotary shell to give suitable gas tight closure.

The prepared coal drops directly from the roaster, which is just above the retort, into a screw feed which discharges at a point close to the upper end of the rotary shell. The coal at 600 deg. F. drops into the shell and is soon heated to the plastic temperature when the formation of lumps or balls begins. These balls roll around inside the shell working their way down to the lower discharge end.

The gas generated during carbonization passes out of the retort through a takeoff at the upper (cooler) end and thence through a wash box to the primary grid cooler at each unit. There

the tar condensing and liquor scrubbing are accomplished. The liquor for spray operation is recycled through a cooling tower. The gas is given a final scrubbing and is returned to the retort furnace for fuel as needed.

PROCESS HEAT SOURCE

Process heating is accomplished with byproduct gas burned in the retort-heating furnaces, one for each unit. Hot flue gas is recirculated by fan through the furnace which is located under the discharge (hot) end of the retort. The maximum temperature in the heating space at this coke-discharge end is automatically held to 1,050 deg. F.

The rate of throughput is wholly determined by the rate of feed. The balls, after forming, roll down the slope and pass out according to the rate of formation from the feed. The retort is largely free space except where the several 8-in. baffle rings give some measure of piling up of the balls at intervals along the retort length.

The burning characteristic of the fuel depends on its volatile matter content, which in turn depends upon maximum carbonizing temperature. As normally prepared the solid product contains 15 to 17 percent by weight of residual volatile matter. This percentage can be varied within limits from 14 to 20 percent.

The new retorts were designed to process 150 tons of dry coal each per 24-hr. day. The yield of fuel is 75 percent of the weight of coal, thus insuring daily 750 tons or more of marketable balls from the seven retorts of the new installation.

BYPRODUCT YIELD

The byproduct yield, as in the development plant, is from 13 to 15 gal. of dry tar per ton of coal. There is no recovery of light oil. The gas yield per ton of this coal is 4,000 cu. ft. of gas at 370 Btu. per cu. ft. The tar output of the plant has been sold to Koppers Co.

The solid product from the retorts goes to a rotary grizzly screen from which the oversize pieces pass through a roll crusher thus limiting the maximum size to about 6 in. The total stream of fuel is then roughly screened to three sizes. The largest size, about 6 to 2 in., is air-cooled by passing over an inclined cooling bed (called a "wharf") of the rocking grate type. The middle size, from 1 to 2 in., is cooled by water sprays. The smallest size, under 1 in., is added to the cooled fuel and the total product is carried on a conveyor belt to the final screening and loading station where three sizes can be loaded into open top

railroad cars. All the undersize is crushed to minus $\frac{1}{8}$ in., this fine material is known as "breeze." It is stored in a silo-type bin.

All the $\frac{1}{8}$ -in. fines from this bin are added to the coal as the latter goes into the feed hoppers above the roasters. Major control of the size and structure of the ball product is accomplished by variation in the percentage of this undersize fine breeze in the feed.

Minor modification of the makeup of the feed to the individual retorts is made by separate feeders for hot fines. The experienced operator by looking at the size, condition, and character of the balls at the discharge end can recognize any need for re-adjusting this addition of hot coke fines.

In order to command general acceptance and give maximum customer satisfaction in the household, the size, strength and analysis of the product must be watched closely. Uniformity of product, to give uniformity of home furnace performance, is almost as important as the absolute characteristics themselves. The long dealer demand shows that this problem has been well solved.

OBJECTIVES OF SYSTEM

In order fully to appreciate the economic and technical meaning of this installation you must recognize four distinct but interdependent objectives. First is the desire to upgrade cleaned coal fines of relatively low market price. Second objective is to prepare a smokeless lump fuel of uniformly good performance in household and small industrial stoves and furnaces. The third, and closely related, objective is to provide a highly reactive fuel which ignites readily and maintains a fire well, all without smoke. Finally, for economic advantage to the processor, there must be formation and recovery of a high yield of liquid co-products of maximum market value. Without credits from the sale of these the over-all operation could not be profitable.

Obviously, Pittsburgh Consolidation Coal Co. has a great stake in this undertaking. It is recognized as one of the means for selling more coal through coal products of wider acceptance than the raw coal itself.

The company is not fooling itself by any false cost-keeping. The processing plant is charged for the raw cleaned fines at the prevailing market price at that point for this material. The plant gets preference over commercial purchasers only to the extent of getting all the raw material it needs for capacity operation.

ECAid for Western Europe . . .

ECA Procurements by Commodity Group and Area of Origin for Western Europe.

April 3, 1948-February 28, 1949
(Millions of Dollars)

Commodity Group	Total	United States	Area of Origin		Participating Countries	Other Countries
			Canada	Latin America		
Fats & oils	225.8	153.7	10.6	11.0	21.1	29.4
Peanuts	45.6	44.9	—	—	—	0.6
Lard & misc. fats & oils	41.5	35.4	0.3	—	5.8	—
Soap, soap stock, & other fatty acids	40.5	28.2	4.1	2.3	4.9	1.1
Copra	30.1	—	—	—	4.1	26.0
Soybeans	27.4	27.2	—	0.2	—	—
Flaxseed	26.8	19.0	5.7	3.1	—	—
Oilseeds, nec.	14.0	—	0.5	5.4	6.3	1.8
Fuel	653.3	287.3	0.1	102.7	126.1	137.1
Petroleum & products	434.4	144.3	0.1	102.7	50.3	127.0
Coal & related fuels	218.9	143.0	—	—	75.8	10.1
Chemicals & related products	122.5	114.4	2.9	4.0	1.3	—
Medicinal & pharmaceutical prep.	25.6	24.7	—	0.9	—	—
Industrial chemicals other than alcohol	34.5	21.2	2.3	—	0.9	—
Alcohol	10.9	8.0	—	2.0	—	—
Pesticides	0.7	0.6	—	0.1	—	—
Other	51.7	50.9	0.5	1.0	0.3	—
Pulp & paper	52.7	13.8	38.6	—	—	0.3
Naval stores (agr.)	10.8	10.8	—	—	—	—

. . . And How They Aim to Use It

Production Indexes for Western Europe, Past, Present & Future

	1935-39 = 100			
	1947	1948-1949 Program	1949-1950 Program	1952-1953 Program
Nitrogen	113	149	177	239
Soluble phosphates	101	136	174	190
Potash	96	123	136	176
Sulphuric acid	90	105	115	142
Sulphur & pyrites	72	83	90	106
Cement	n.a.	100	n.a.	130
Plastics	159	200	n.a.	480
Dyestuffs	81	100	n.a.	189
Textile fibers: total	83	98	108	121
Cotton	71	83	94	99
Wool	106	121	130	140
Synthetics	111	n.a.	n.a.	285
Newsprint	53	64	70	88
Paper & cardboard	71	87	93	118
Processed rubber	120	150	160	200
Oils & fats	77	80	92	115
Aluminum	169	212	243	297
Copper	101	119	132	158
Lead	60	72	78	99
Zinc	88	102	107	131
Crude oil (throughput) ¹	98	174	231	480
Total Exports of Overseas Territories	1946 or 1947			1952-1953
Coal	18			147
Phosphates	140			300
Metals & ores ²				
Lead (as Pb)	132			300
Zinc (as Zn)	293			522
Copper (as Cu)	97			131
Tin (as Sn)	61			145
Barite	235			414
Rubber	84			300

¹ Excluding Switzerland. ² This item reflects the large increase in refining capacity which is planned. The increased crude oil throughput is accompanied by a reduction of imports of refined petroleum products. ³ These data are calculated on the basis 1937-8 = 100.

SEABROOK HULL

The concerted effort of Western Europe is aimed at recovery. Today, that means good business for U. S. industry. Chemical exports are running better than \$200-million a year—five times prewar figures. ECA is footing most of the bill.

Tomorrow, European recovery means partial loss of market for American products, and what's more, increasing competition from Europe both on world export markets and in the U. S. itself. As European production targets are reached, domestic needs met, and commodities added to export lists, a downward shift in markets for U. S. commodities is inevitable. Odds are, though, that it will never drop to prewar levels.

Plagued by a mammoth trade deficit with the dollar area, one of ECA's primary objectives is to cut European imports of American goods—at the same time, increase exports to the western hemisphere.

A dim outlook? Maybe, but the recognized alternative is practically no market at all, rather a bankrupt and communist Europe. ECA is planned to reverse that. And, so far, it's working.

In effect, because of ECA, foreign markets for many U. S. industrial commodities will finally stabilize below present levels. For example, nearly every country in western Europe has big plans for expanding synthetic fiber production. In 1953 Western European exports of dyestuffs will hit 80,000 tons. Plastics are another field in which Europe hopes to become better than self sufficient. There are many others.

However, there will be exceptions where markets will expand rather than decrease. One is crude sulphur. Be-

SEABROOK HULL joined McGraw-Hill's Washington staff in 1947. ECA is his beat.

One by one, ECA nations are mapping recovery plans, setting sights for increased

cause many European chemical industry expansion plans are based on the manufacture of sulphuric acid, it is estimated that, based on current production and availability, 1953 will see a world shortage of 1,200,000 metric tons of crude sulphur. Attempts are being made to develop new sources, but the U. S. will be the main supplier.

Marshall Plan Europe's dependency on imported nitrogenous fertilizers will be cut far below current levels. In the aggregate, Western Europe hopes to increase production from a current 1,900,000 metric tons (nitrogen equivalent) to 2,700,000 tons. Proportions of nitrogenous fertilizers will decrease in favor of potash and phosphates.

One thing strikingly apparent in a study of Western Europe's chemical industry plans are the number of countries studying synthetic liquid fuel production. In the Mediterranean, Greece hopes to produce a whole line of products through the treatment—based on German technology—of lignite.

Austria is seriously considering synthetic liquid fuel production from coal. Norway is running preliminary studies on the practicability of meeting her domestic requirements through treatment of the Svalbard coal deposits.

In the next three years imports of crude and refined petroleum will increase 9 percent. The amount coming from the western hemisphere will decrease. Value of crude and refined products will reverse positions. Reconstruction and new construction of refining plant is planned in virtually every country in Western Europe. In 1948-49 (fiscal year) crude oil imports to Marshall Plan Europe totaled \$327-million—\$159-million came from western hemisphere sources. At the same time \$935-million worth of refined petroleum products were imported, with \$512-million of that coming from the western hemisphere. In 1952-53, European purchases of crude oil will top \$860-million; refined products imports will run close to \$630-million, with \$311-million and \$324-million respectively coming from the western hemisphere. Dollar values in 1952-53 are figured at 1948-49 prices.

One of two things will mark the beginning of the declining demand for U. S. chemical products: either the end of ECA aid in mid-1953, and with it, the end of "free" dollars; or as the completion of present European industrial expansion plans starts to effect production figures. The latter should be the first to affect markets, and its effect will be gradual. Also, ECA

grants are scheduled for systematic reduction all the way through to the end of the program. Thus, when ECA does end, there should be no marked impact on chemical orders from abroad.

As part of its preparation for Congress, ECA developed detailed reports on the various Marshall Plan countries. From these, from reports from the OEEC (Organization for European Economic Cooperation, made up of the countries themselves), from statements of the ECA country missions, and other reports from abroad, Chemical Engineering has prepared detailed studies of chemical industry plans country-by-country.

The Interim Report of the OEEC, largest single source for the information that follows, contains certain inequalities. For instance, European countries plan to export to one another somewhat more than they plan to import from each other. In addition, their plans show a considerable net dollar deficit with the western hemisphere at the end of the program. These inequities still have to be rationalized. The OEEC right now is working at the task of coordinating the individual country programs into a realistic and workable whole.

In all cases, dollar figure projections are based on 1948-49 prices. Prewar values are actual dollar figures for those years with no corrections for changing prices. All tonnages are in metric tons (1,000 kg. or 2,204.6 lb.)

With the most important chemical producers first, the country studies follow:

● **UNITED KINGDOM**, second largest chemical manufacturer in the world, is spending upwards of \$70-million a year in North America for such things as molasses, alcohols, solvents, oil derivatives, and basic chemicals for its fast-growing plastics industry. Plans—entailing some \$800-million worth of expansion—are not only to eliminate this deficit but to provide a surplus for exports as well. Plans are to boost exports by \$164-million.

Current U. K. exports of chemicals are more than 56 percent above the 1938 level. In 1952 they will be almost double. Special emphasis is being placed on increasing exports of organics, plastics, dyestuffs, byproducts of the oil-cracking industry, refined petroleum products, synthetic fibers, and basic chemicals, especially alkalis.

Production of plastics by the end of the program will triple prewar, making imports unnecessary.

Of the U. K.'s total chemicals investment program, \$40-\$50-million is earmarked for the dyestuff industry.

Already producing 95 percent of requirements, a 30 percent expansion of production is planned. Increasing demands of industry for newer and faster dyes will be met, and some provided for export. At 38,000 tons in 1938, production is expected to hit an annual rate of 45,000 tons by the end of 1949.

Synthetic fiber production, averaging 61,200 tons before the war, is expected to expand from a current 122,000 tons to 200,000 tons in 1952-53. Of this, 22,000 tons will be for direct exports. Most exports, however, will be as finished textiles. Though bulk of the expansion is planned for rayon, new synthetics will also make their appearance, such as asterylene, highly resistant to chemicals and moisture, and aridil.

Great Britain hopes to raise crude oil production from 64-million tons in 1948 to over 100-million tons in 1953. Through the construction of seven new refineries at a cost of \$500-million, English refinery capacity is expected to hit 20-million tons a year in 1953, against 2.5-million tons in 1947. In addition, British overseas refinery capacity will be increased 40 percent over 1947.

Production of nitrogen fertilizer will be expanded only to meet domestic demands and supply the long-established export market. Expansion planned in Europe, North America, India, and Australia presents no justification for further U. K. production increases.

Emphasis, however, will be put on the production of superphosphates. Phosphoric acid plans call for a 100 percent increase in capacity, half of which will be completed by the end of 1949.

Titanium oxide: One plant alone at Grimsby, England, British Titan Products, now running at 45 tons a day will add another 30 tons to production. National Titanium Products is going to install another similar plant at the same location. Total daily production at Grimsby will run well over 100 tons.

Meanwhile, new plants to produce neon gas, urea, vinyl, chloride, and chemicals from oil will be in production well before 1952.

U. K. chemical exports to the U. S. for the first six months of 1948 were \$6.5-million of coal-tar products, medicinals, industrial chemicals, pigments, paints, varnishes, nitrogenous fertilizer materials, and \$732,000 of rayon filament not over 30 in. long.

● **FRANCE**, number three world producer of chemicals, plans not only to recapture traditional markets for French production, but has her eye

production. From these, U. S. producers may gage their future competition.

on new ones as well in central and eastern Europe, India, and South America. First on the list for increased production are superphosphates, compound fertilizers, dyestuffs, and synthetic fibers.

Fertilizer production must first expand to meet domestic requirements, which are increasing. Here's how major fertilizer plans work out, consumption vs. production, excess or deficiency to be exported or imported.

Tons of Fertilizer

	1948-49	
	Production	Consumption
Nitrogen (N).....	180,000	240,000
Phosphate.....	543,000	464,000
Potash.....	740,000	312,000

	1952-53	
	Production	Consumption
Nitrogen (N).....	350,000	450,000
Phosphate.....	980,000	800,000
Potash.....	940,000	700,000

In addition, production of natural phosphates in the territories is expected to rise from a current 5.6-million tons a year to 7-million tons in 1952-53.

French dye production now at 18,000 tons is earmarked for expansion to 34,000 tons by the end of the four-year program, contributing heavily to total western European exports of 80,000 tons of dyestuffs.

Metropolitan France's fats and oil production, now at 170,000 tons a year, less than prewar, may get as high as 960,000 tons. French African output of fats and oils is planned to increase from a 1947-48 figure of 215,600 tons to 470,700 tons in 1952-53.

Artificial fiber production is already 80,000 tons a year, double prewar. It is expected to reach 150,000 tons in 1952-53.

Among the basic chemicals, sulphuric acid plays an important roll in France's program. Raw sulphur imports are estimated to hit 840,000 tons in 1952-53.

Plastics industry is earmarked for considerable expansion, but plans are not yet detailed.

Production of glass, refractories, ceramics, and rubber is scheduled to remain pretty much as is.

German reparations have contributed to France's chemical production. Included in the transfer are a sulphuric acid plant with 36,000 ton-a-year capacity, and production facilities for 2,160 tons of formaldehyde and pentaerythritol, and vanadic acid production equipment.

Indochinese rubber plantations, producing 60-70,000 tons before the war, plan a 1952 output of 110,000 tons, 60,000 tons to go to France, and 50,000 tons for export abroad.

In metric tons, 1952-53 exports for

metropolitan France are expected to run for chemicals, 13,000; artificial textiles, 20,000; artificial fibers, 18,000; pulp and paper, 10,000; fats and oils, 37,000.

In millions of 1948 dollars, French imports are forecast as follows: crude oil, \$249.8; rolled copper, \$100; other ores and nonferrous metals, \$95; fertilizers (nitrogen), \$26; and little in the way of chemicals, except raw materials.

Actually total French imports are expected to run over \$2 billion, of which \$365 million will come from North and Central America, less than half the 1948 rate. Chemical industries will feel their share of this cut, sulphur excepted.

French exports in 1952-53 to South America will include \$25 million of chemicals, \$40 million of ores and metals.

French chemical exports to the U. S. for first six months 1948: rayon, other synthetic textiles, and their manufactures, \$3.2 million; paper and paper products, \$3.4 million; coal-tar products, industrial chemicals (argols, tarters, wine lees), fertilizers, soap and toilet preparations, \$1.5 million.

● **BENELUX** is a customs union—eventual objective, political union as well—of Belgium, Netherlands, and Luxembourg. Though still in the formative stage, the three countries are treated as one by the O.E.C. Here are their chemical industry plans.

With salt and coal almost the only indigenous raw materials for a chemical industry, Benelux is primarily a chemical processing area. All other raw materials must be imported. Already a major producer of heavy chemicals, pharmaceuticals, aniline dyes, plastics, molding powders and dyes, plans for new production envisage synthetic phenol, films, dyes, new pharmaceutical and phytopharmaceutical products.

Material expansion plans of oil refining plant will initiate the manufacture of chemical derivatives, particularly synthetic detergents. This means both a cut in imports from dollar areas and an increase in exports to both participating and non-participating countries.

Oil production in the Netherlands alone has jumped from 62,600 tons in 1946 to a current 600,000 tons a year. Benelux refinery expansion will raise processing capacity from 2.6 million tons in 1948-49 to 6.4 million tons in 1952-53. Some of these are international refineries supplying other markets besides Benelux, but do not count Standard Oil (N. J.)'s scheme for setting up a 1.6-million-ton-per-year refinery in Belgium. Annual exports of refined products are estimated

at 2 million tons with a value of \$78 million by the end of the program.

Through a 55 percent expansion in existing plants, plans are to raise nitrogenous fertilizer production from 260,000 tons a year now to 420,000 tons in 1952-53. This will leave a considerable margin for export, one third of which will go to other Marshall Plan countries, the rest to non-participating countries. Some imports will continue to be made from Chile, due to farming techniques and traditional trade policies.

Currently there is no production of potash chloride, nor is any anticipated.

Already self-sufficient in soluble phosphates, the only increase in output foreseen will be that resulting from increased steel production. However, purchases of phosphate rock in the future will shift from dollar sources to North Africa. Again due to traditional import practices, some will be bought from Kola.

Benelux has no synthetic rubber plants, nor are any planned. The countries, however, will resume their prewar role in the transit trade in raw rubber from Indonesia, Malaya, and the Belgian Congo. The rubber processing industries plan not only to take care of domestic needs, but to produce enough for large scale exports as well.

Chemical imports in terms of dollars are expected to tend more and more to specialties and certain lines of pharmaceuticals.

Netherlands exports of chemicals to U. S. for first six months 1948 were \$146,000 of industrial chemicals, and \$39,000 of fertilizers.

Belgian exports to the U. S. for the first six months 1948 included \$2.1 million of creosote oil, cobalt oxide, radium salts, and potassium chloride crude fertilizer materials.

● **ITALY**'s chemical industry suffered only slight war damage. Of \$800 million capacity only \$500 million is effective of which \$59.5 million is export production. The main worry is not so much expanding present capacity as it is utilizing it. Production of basic chemicals, caustic soda, sulphuric acid, fertilizers, exceeds prewar but in many cases has declined below 1947 due to a lack of demand.

Both nitrogenous fertilizers and superphosphates are exported in sizable amounts despite the fact that only a portion of productive capacity is utilized.

Exports of caustic soda are expected to drop off as world supplies catch up with demand.

For this reason Italy has earmarked less than \$70 million for chemical plant expansion out of a total four year investment program of \$1.670

European recovery may hurt some markets for U. S. chemicals. But it will help

million in Italian and ECA funds.

One of the largest Italian chemical industry exports in 1952-53 will be refined petroleum products, to hit 3,400,000 tons. Italy hopes to reach this figure by importing 9,600,000 tons of crude oil, and producing 8,750,000 tons of refined products. A \$2 million petroleum loading dock at Naples, recently approved for construction with Italian counterpart funds, will facilitate this trade. The dock when completed will be capable of unloading 2,000,000 tons of crude oil, and loading 2,000,000 tons of refined products a year.

Production and export figures of some important Italian chemicals are detailed below with production and export figures for 1952-53 (in tons).

	Production	Export
Nitrogenous fertilizers, N	210,000	80,000
Phosphate fertilizers, P ₂ O ₅	340,000	10,000
Copper sulphate	140,000	—
Sulphuric acid	1,400,000	—
Sodium carbonate	230,000	—
Caustic soda	290,000	—
Synthetic dyestuffs	22,000	10,000
Pharmaceuticals	8,000	—
Synthetic resins	33,000	2,000

Best quantitative indication of Italian synthetic textile fiber production is given by the projected increase in the industry's labor force which is estimated at 60 percent. Plans are to increase production of rayon, already an export item, and to convert many existing chemical plants to the production of staple fiber (fiooco).

Cellulose imports and finished product exports are planned mainly to and from countries not in the dollar area.

Italian chemical exports to the U. S. during the first six months 1948 included \$3 million of rayon and other synthetic yarns; argols, tartars, wine lees, \$184,000.

● **AUSTRIA's** production of chemicals is 50 percent above 1937, in spite of the fact that the industry is operating at a bare 75 percent of capacity. Most recent additions to production lists are heavy chemical salts and fine inorganics. Also a coal gasification plant has just been completed. Production is increasing in heavy chemicals, glass, soaps, rubber products, adhesives, paints, matches, wax products, photosensitive materials, inks, and pesticides.

No attempt will be made to change Austria's inherent position as a non-producer of organic and inorganic raw materials between now and 1952-53. However, expanded production in the nitrogen, soda, and rubber-processing industries will mean a 100 percent increase in chemical exports over 1937. The increase will be primarily based on high exports of nitrogenous fertilizers, and the recapture of the Eu-

ropean market for rubber goods. Lithopone also will be exported.

With increased capacity in the chemical processing industries, imports of chemical raw materials must necessarily increase over the next few years. Sulphuric acid production will be increased to 26,000 tons a year in 1952-53 and will take care of half of Austria's requirements. Carbon disulphide, phenol, and cresols, also will be produced but won't have any material effect on imports.

Expansion in oil products manufacturing is also planned as well as the construction of a carbide plant.

Glass production was running at 36,000 tons in 1947, 80 percent of prewar. In the future, Austria will be able to supply all her own flat glass requirements, but will have to import certain kinds of plate, refined concave, and technical glass. Exports will consist of paste jewels, fancy goods, ground glass, and glassware.

Austrian investment plans for the four-year program include \$45-million for the chemical industry and \$9-million for the paper industry—out of a total of \$1,200-million for all industrial investments.

Austrian chemical exports totaled \$3.2-million during first nine months 1948, against \$8-million imported.

Chemical exports of Austria to the U. S. for first six months 1948 included only \$193,000 of sulfite wood pulp and newsprint.

● **NORWAY's** chemical industry has a double base, electrochemicals and wood products. Based on an ambitious expansion of hydroelectric power production, current output, equal to prewar, will be doubled in 1952-53.

With a 1938 base of 100, chemical and electro-metallurgical production index for August-October 1948 was 94, and rising. Pulp and paper production index was 106, also rising.

Annual export rate for 1948, based on January through September, was \$26.6 million; timber and timber products, pulp and paper exports hit \$120.8 million.

Value of Norwegian chemical exports (including fertilizers) is scheduled to rise to \$52 million in 1953; of ores and metals, from \$46 million in 1947 to \$77 million. Of all exports as a whole, 8 percent is scheduled to go to the U. S., 4.5 percent to South America, 67 percent to participating countries.

Present production expansion plans are aimed at aluminum, copper, zinc, nickel, and electrochemicals such as fertilizers and carbide.

A forced expansion of electric power beyond present plans will mean even greater increases. Meanwhile, Nor-

way is also seriously considering synthetic fuel production from the Svalbard coal deposits sufficient to meet domestic requirements.

Here are production estimates of some important Norwegian commodities; bulk of increases are for export.

	Thousand Metric Tons		
	1938	1948	1952-53
Nitrates (N)	75	105	175
Cyanamide (N)	—	40	80
Calcium carbide	51	20	60
Mechanical wood pulp	859	750	850
Chemical wood pulp	455	420	500
Paper	325	425	450
Cardboard	41	45	50
Wallboard	—	50	80
Aluminum	29	30	95
Copper	11	11	13
Nickel	3	9	14
Zinc	46	42	46
Magnesium	—	—	8
Urea	—	—	10
Cement	330	500	750
Titanium iron ore	—	100	180
Pyrites	1,028	750	800
All artificial fibers	—	—	11
Coal	—	400	680

Norwegian chemical exports to the U. S. first six months, 1948: Synthetic filaments not exceeding 30 inches in length, \$86,000; nitrogenous fertilizer materials, \$183,000; wood pulp, \$1.4 million.

● **BIZONE GERMANY's** chemical industry plans, detailed below, are based on conditions as they were before the three western occupying powers came to an agreement on what to do about the Industrial Advisory Committee Report (the so-called Humphrey Committee).

In the report recommendations were made for retaining, in whole, 34 Western German (including the U. S., U. K., and French zones of occupation) chemical plants, and in part, one additional plant. Out of a total of 75 plants studied, therefore, 40 would be released for reparations.

As finally approved by three-power agreement, 32 chemical plants will be retained in whole, none in part, and 43 released for reparations. Of a total of 11 non-ferrous metals plants originally scheduled for reparations, 7 will be retained, and 4 released. Of those chemical plants to be retained, 23 are I. G. Farbenindustrie.

Retention of the 32 plants in Germany will probably reduce chemical industry investment plans somewhat, decrease necessary total of a number of imports, at the same time causing an increase in some exports. In any case, occupation costs as a result of this agreement should be considerably reduced, and recovery of Western Europe as a whole increased.

With this in mind, chemical plans for Western Germany present the essentials of the picture for the next four years.

Chemicals now comprise only 4 per-

others, and the alternative is no market in Europe at all.

cent of bizon exports—in 1952-53 they are scheduled to make up 14 percent. Over the next three years, plans are to invest 650,000 tons of steel and the equivalent of \$330 million in expanding chemicals production.

This investment program will go towards expanding output of organics, soda ash, carbide, sulphur, sulphuric acid, fertilizer, phenol, and caustic soda. In 1952-53 coal requirements are estimated at 93 million tons. Petroleum products requirements will top 3,300,000 metric tons in 1952-53. Therefore crude imports will jump from a current 690,000 tons now to 3,250,000 tons in three years.

The industry will tend towards its prewar pattern when it supplied domestic industries such as pulp, paper, leather, textile and electrical products, as well as export markets.

By 1952-53 Bizonia expects to import virtually no nitrogen or phosphate fertilizers.

Chemical fiber production at an annual rate of 220,000 tons in 1938, will be increased from a current 52,000 tons a year to 150,000 tons in 1952-53, cutting about \$16 million off annual wool, and cotton imports.

With the largest share of the pulp and paper industry in the Russian zone of Germany, the Bizon plans to produce 1,200,000 tons of paper and cardboard in 1952-53 and 600,000 tons of chemical and mechanical pulp, raising per capita availability from domestic sources to a little more than half of prewar. Roughly \$20-million worth will be exported.

● **FRENCH ZONE** of Germany's chemical industry in 1952 is scheduled to be producing at 142.7 percent of the 1936 rate.

Chemical industries will take the biggest single share of coal, 1,500,000 metric tons out of a total 8,039,000 estimated to be available.

Value of chemical exports in 1948 dollars is estimated to top \$70 million. Some chemical imports for 1952-53 are forecasted as follows:

	Tons	\$1,000
Crude oil	28,000	600
Other petroleum products ..	293,000	14,000
Alumina	82,355	5,424
Unprocessed metals	20,812	12,280
Misc. non-ferrous metals ..	1,085	200
Fertilizers		6,106
Misc. chemical products ..		9,900
Cellulose	12,600	2,268
Natural rubber	8,100	4,050
Carbon black		468
Tanning products		1,080

Western German exports to U. S. for first six months 1948: Synthetic fibers and manufactures, \$1.9 million; chemicals and related products, including coal tar products, and fertilizers, \$770,000.

● **SWEDEN's** timber products industry is stepping up production and exports of viscose and bleached paper pulp. Fertilizer production may show increases, stepped-up use forecasts import increases by the following amounts in 1953: nitrogen, 50,000 metric tons; potash, 50,000 tons; phosphates, 115,000 tons.

Some major export and re-export figures: (fob)

	1947	1952-53
	Millions of Dollars	
Oil & petroleum products ..	0.8	0.8
Ores & metals	113.7	209.5
Forest industry products ..	476.7	630.8
Imports for Same Period		
Fats & oils	28.1	48.1
Crude oil	8.6	10.1
Refined petroleum products ..	82.9	75.4
Copper	24.0	29.5
Other ores, metals	47.3	52.3
Fertilizers	16.1	21.1

During first six months of 1948, Sweden exported to the U. S. \$37.8 million of wood pulp (sulphite and sulphate), \$157,000 of arsenic trioxide, \$68 million of paper and products.

● **GREECE** will base her chemical progress on substantial deposits of bauxite, lead, zinc, antimony, chromite, magnesite, manganese, nickel, and lignite.

Production plans take into account a number of items, though none of them on a tremendous scale. An interesting feature is the proposed use of German technology for the production from lignite of items normally produced from coal. Some of these include industrial gas, liquid fuels, dyestuffs, and electric power.

By commodity here are some of Greece's more important chemical plans:

Magnesium: Plan to build two 5,000 ton per year direct chlorination plants.

Alumina: As hydroelectric power becomes available, production of aluminum will be started and increased up to 30,000 tons a year. Meanwhile exports will be 60,000 tons of alumina.

Sulphur oil production will be raised to 12,000 tons, half of which will be for export. Glycerine and fatty acids will be produced as byproducts of sulphur oil production.

Refractory production will be raised from 1,600 tons a year to 10,000 tons, filling domestic demands and supplying magnesite and chromite refractories for export.

Nitrogen fertilizers: Current production runs somewhat over 20,000 tons a year. Plan to raise production of ammonia, and subsequently calcium nitrate and ammonium sulphate sufficient to meet own demands.

Sulphuric acid production — by chamber process—is now 90,000 tons a year, leaving none for export—pro-

duction increase plans call for another 80,000 tons.

Phosphate fertilizer: By importing phosphate rock, Greece figures it can produce 200,000 tons of superphosphate at 67 percent of the world market price. Cheap production of 26,000 tons of concentrated phosphate and 18,000 tons of nitro-phosphate is also planned.

Sodium Fluosilicate—A byproduct of phosphate rock treatment—will be exported at the rate of 400 tons annually until completion of an electrolytic alumina plant requires it to be processed into cryolite.

Caustic Soda: Plans call for production of 15,000 tons of caustic and 25,000 tons of soda ash. Byproduct chlorine will be used to make 40 percent P_2O_5 dicalcium phosphate and in the processing of magnesium.

Lithopone: To produce 3,000 tons a year at a cost less than half world market price.

Dyestuffs: Plan to meet domestic requirements with byproducts from processing of lignite and crude oil.

Crude Oil: To construct a 400,000 ton refinery which will take care of one third of domestic needs.

Rubber: Plan to cut imports to 300 tons in 1952-53.

Greece exported to the U. S. during first six months of 1948 \$333,000 of edible olive oil and \$789,000 of inedible olive oil.

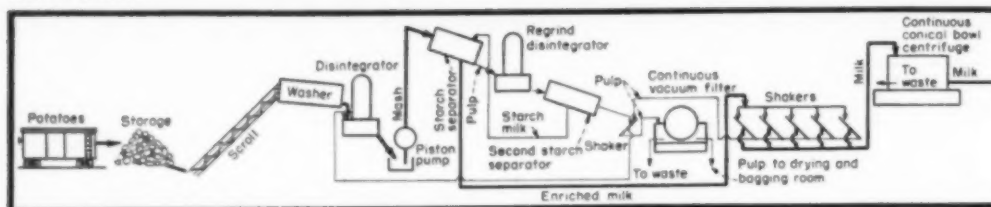
● **TURKEY**, like other countries, has dollar exchange trouble too, but unlike most others she is not getting any "free" U. S. money, nor does it look like she will. As a result, her plans may not seem as ambitious as some others. Most plans are under consideration and scheduled for the future as dollars become available.

Immediate plans are to invest \$3.7 million in a fertilizer industry in order to contribute to total European nitrate fertilizer production. Potash and phosphates will continue to be imported. Other plans are to invest \$9.5 million in an organic chemicals industry based on distilled coal products and alkalis.

Only significant exports of a chemical nature to U. S. from Turkey during first six months 1948 were \$3.2 million worth of crude opium, and \$3.2 million of chromite.

● **PORTUGAL** has no intention of materially changing the traditional structure of its economy which has been primarily agricultural. However, at least one new industry has been started since the war, that of pulp and paper. Production here is earmarked for expansion to 20,000 tons of cellulose pulp and 10,000 tons of paper in 1952-53. Other plans call for eventual expansion in petroleum refining.

New Process



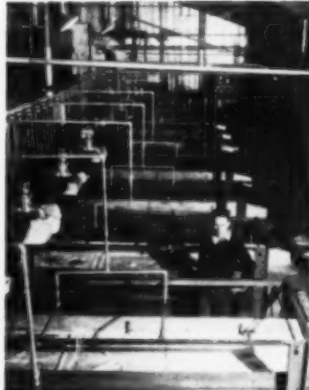
New Equipment



HAMMER MILLS, used instead of rasps, are sturdier and have larger capacity.



SEPARATORS use brushes and counter-current washing to separate pulp and milk.



SHAKERS, equipped with phos-bronze wire cloth, screen pulp from milk.

Idaho starch producers are capitalizing on these cost-reducing tools of modern process engineering. With new processes and up-to-date equipment they're forging a . . .

Potato Starch Comeback

HAROLD E. REICHENBERG

For something like a century, potato starch has been made by a process that has changed little, definitely has not kept closely in step with engineering advances. But the industry now recognizes that manufacturing methods must be modernized, research intensified, old products made better and new ones developed, that economics of the industry needs a good shaking down. The signs of senes-

cence are disappearing, and there are stirrings which indicate that the potato starch industry is about to enter a new era of growth and health.

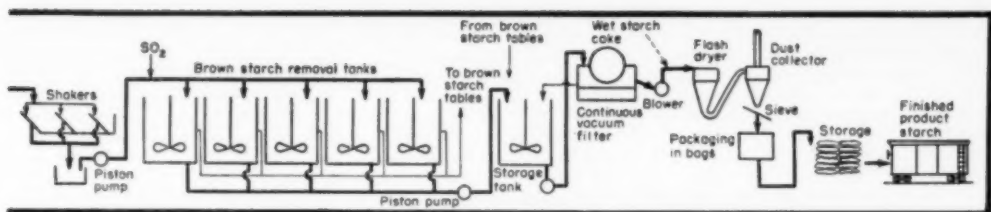
It has to. The industry is still surrounded by dangers that threaten its health and very existence: (1) price and quality competition from other products; (2) a new flood of starch imports; (3) excessive productive capacity; (4) erratic prices and seasonal operations; (5) the vicissitudes inherent in any industry tied to an agricultural product that is subject to political manipulation; (6) askew plant and product integration.

Potato starch manufacturers must

be able to meet the price and quality competition from corn starch and other products—and still operate on a sound financial basis. In recent years, the productive capacity for all starches in the United States has increased enormously. This, with technological improvements, makes it possible to substitute one starch for another in a wide range of uses; ten years ago, substitutions were not so readily made. It's obvious that the cheapest starch is the one most likely to be used; very often it is not potato starch.

Starch producers must also decide on a standard specification for their product, a move long over-due. This

Mr. Reichenberg is a chemical engineer with Western Products Co. in Emmett, Idaho.



specification must be in line with the consumers' needs and recommendations, not with the producers' idea of what the product should be like. Starch manufacturers must carry on even more cooperative studies with starch users. That's one good way to meet competition. Each plant should have a laboratory to see that a standardized quality is maintained and to carry on technical service work for customers.

The textile industry uses about 40 percent of all potato starch in this country; this market is shrinking. The food and confectionery industries use about 25 percent; dextrine close to 15 percent. The next largest market—and one that is growing—is the paper industry. Finally come the plastics and miscellaneous uses.

THE PEG AND THE HOLE

There are signs that the starch supply peg is getting bigger than the market hole. This results from: (1) expanded capacity for corn and other starches; (2) large tonnages again available from Holland; (3) the increased productive capacity for potato starch.

Holland, the world's largest producer of potato starch, is making more starch than during the prewar years. Dutch output this year will probably exceed 250,000 metric tons—about four times the United States capacity. Most of the Dutch product is available for export; the price is low and the quality is topnotch; the United States tariff on this starch is the lowest since 1922. The threat to the domestic potato starch industry is obvious.

In 1941, Maine was the chief starch-producing state; production was less than 20,000 tons. The industry in Idaho has since grown to six plants with a capacity of over 30,000 tons per 200-day operating season. This output, combined with an estimated 30,000 tons from Maine's 21 plants, would create a surplus on today's markets if all plants operated at capacity. Now that government and other post-war purchasing of starch is evidently declining, it is doubly important to the financial stability of the industry that all plants be operated at peak effi-

ciency. My slants on how will be given later.

Producers of potato starch must also formulate a long-range price program so that the user will not be forced to pay speculative prices in time of scarcity. Again, potato starch is not generally available in the summer; but corn starch can be had in any reasonable amount throughout the year. This situation puts a distinct handicap on efforts to enlarge sales outlets for potato starch.

Now we come up against that last danger that threatens the health and existence of the potato starch industry: askew plant and product integration.

MULTIPLE-PRODUCT PLANTS

To meet today's problems of producing a quality starch acceptable to the consumers' standards and of meeting the price scale of competitive products, the potato starch producer can (1) increase capacity to lower unit costs and (2) diversify products to make better use of raw materials. Trends in both these directions are evident in the Idaho starch industry.

Newer plants in Idaho are built to handle larger tonnages. A small increase in initial investment and very little additional operating expense will increase the tonnage output and—this is more important—reduce appreciably the unit cost of making the product.

By combining a starch plant with other potato-processing units, the potatoes can be used to greater advantage. The better grades can be made into products that have a premium price, such as potato chips, dehydrated potatoes or potato flour; the poorer grades can be processed into starch, the byproducts into industrial alcohol. This consolidation of plants is one way a producer can lower production costs. Chemical processing and food processing merge.

A combination plant will also make a direct saving in the cost of producing each product because (1) one laboratory can be maintained to standardize all products; (2) the maintenance crew can be pooled for work in any of the units on any shift; (3) byproducts

from all the units can be handled in one unit for processing or disposal; (4) water rates will be lower; (5) sewage treatment and steam generation will be simpler and cheaper.

MODERNIZE THE PROCESS

A great deal of work is being done to streamline starch-producing methods so as to capitalize on the cost-reducing aspects of modern process engineering practice. Basically, the manufacture of starch simply involves the separation of pure starch from all other soluble matter in the potato. The methods vary considerably, but every processor should select equipment carefully so as to avoid shutdowns and have equipment standardized so that repairs or replacements can be done quickly. The following process illustrates one of the most modern methods used in Idaho to make potato starch (see flow chart). It has several technological innovations that help to lower processing costs and to guarantee a uniform quality product.

Potatoes are weighed and dumped into a bin to be distributed by overhead conveyors to any section of the storage cellar. This cellar has a series of flumes which use recirculated water controlled from the main processing building. Great care should be used in piling the potatoes so that they will remain in good condition for the starch operation. One man feeds the potatoes to the grinder.

Potatoes first pass over a magnetic separator, an air or water type de-rocker. They are then conveyed to the washer by a thick-wall scroll inclined at about 25 deg. One-inch holes in the bottom of the scroll housing allow free passage of flume water, which goes to the recirculating pit where sludge and foreign material are removed; it is then recirculated to the storage building flume. The potatoes are washed thoroughly in any standard potato washer to minimize the ash content of the starch.

Potatoes drop by gravity into either a hammer mill or disintegrator with a 1-in. screen. A mill of this type is used instead of a saw blade rasper

since it has a sturdier construction, and its speed of rotation gives it a greater capacity. Pebbles and other foreign material often cling to cull potatoes; these damage the rasper type mills. Our comparative tests on operations after using a rasper, hammer mill and disintegrator have shown that there were no noticeable effects on the final recovery although the higher speed machine increases the settling time from five to nine hours. Since the rate of settling is not particularly important, it is obvious that a hammer mill or disintegrator has definite advantages. Of the six Idaho plants, four now use hammer mills and one a disintegrator.

Water from the pulp screening is used in sufficient quantities for efficient grinding. Mash from the grinding operation is pumped to the first of two separators by a standard sledge-type bronze-fitted piston pump. A piston pump is used for this operation (and throughout the plant, wherever possible) to prevent turbulence.

The separator is a cylindrical screen with a 35-mesh phos-bronze wire cloth or an equivalent perforated plate. It uses countercurrent rotating brushes and countercurrent washing. Pulp passing out of this separator is re-ground in a second hammer mill or disintegrator equipped with a 1/16-in. screen. Re-ground pulp goes to a second separator; pulp from this passes over a shaker where it is washed thoroughly to remove all available starch.

Pulp from this screening operation passes to the collection area for further processing or disposal. The water—containing small amounts of starch—

is used for the initial grinding operation already described. Milk passing through the second separator is used to wash the first separators.

THE SHAKERS

Enriched starch milk from the first separator passes over one of five shakers connected in parallel. These are equipped with 100-mesh phos-bronze wire cloth. The shakers, using reciprocating motion, have copper troughs at 2.5-ft. intervals along a 7.5-ft. surface; the troughs are about 2.5 in. wide and 1.5 in. deep and run the full width of the shaker. A fine spray of water over the troughs helps to spread out the fine pulp particles over the entire screened surface and thus to prevent channeling. Just enough water is added to avoid blinding. Pulp from the screening operation is conveyed to the pulp shaker (described above). A standard type piston pump sends the milk passing through the shakers to a continuous conical bowl separator.

Protein water from this centrifuge can be processed or disposed of; the starch milk is refined by pumping it (standard-type piston) over one of three shakers hooked in parallel (similar to those described above) except that it is equipped with a 120-mesh wire cloth. Pulp from this screening joins that from other screening operations; the milk is sent by a piston pump to one of five vats equipped with agitators.

Then SO_2 is added to the milk to bring the pH to a range of 3.5. The liquid—with starch in suspension—is allowed to settle; the liquid is then drawn off by a self-priming centrifugal pump. The brown starch is drawn off and tumbled in cement troughs approximately 40 ft. long. Fresh water is added to the remaining starch while the agitator is turning.

After the starch is thoroughly in suspension, the milk is sent by a piston pump to the continuous vacuum filter storage tank along with any starch from the brown tables. Fresh water is added to this vat until the milk has a baume of 13-18 deg. The filter can either be a bronze-fitted

standard disk type or a starch-type drum filter equipped with puddling arms. If a disk type filter is used, the feed will have to be increased one-third more than that needed for the filtering operation; this is so that sufficient overflow can be drawn from the bottom to prevent settling out. Air agitation is not a satisfactory way to give circulation since it causes a small amount of foaming and considerable plugging.

FLASH DRYING

The starch leaves the filter as a solid with approximately 40 percent moisture. It now goes to the flash-type dryer which brings it down to its final moisture content within a few seconds. The dryer must be equipped with sufficient dust collecting equipment to insure efficiency and to prevent explosions. All electrical equipment must be dust-proof.

Our experience has shown that flash drying has definite advantages over the other methods now used: (1) it gives considerable savings in original investment; (2) operating floor space is reduced; and (3) processing costs are lowered. Four of the six Idaho starch plants now use flash dryers.

Starch from the drier is screened through a silk cloth (to remove any pearls) and bagged by any standard closing device. If the starch is sent to cotton textile mills, the bags will ordinarily be of cotton and of 100-lb. size; otherwise the standard paper starch bags are used.

WHAT'S COMING

Perhaps it's true that the past of our potato starch industry has not been one marked by progressiveness. But let's give credit where credit is due: this is now generally recognized in the industry and—most important—something is being done about it. Technological improvements are being made, new processes are being developed, and research is being intensified—research to improve the quality, to better the competitive cost position and to find new uses and markets for American potato starch.

Potato Starch Made in the United States

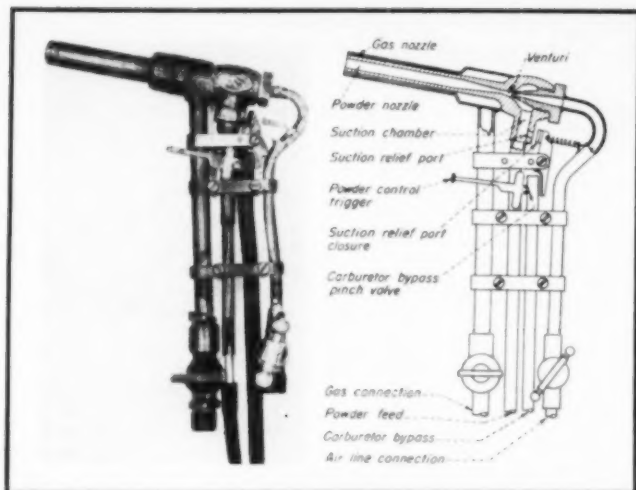
Crop Year	Potatoes Used, 1,000 Bu.	Starch Made, Tons
1941	4,992	17,780
1942	3,308	12,039
1943	10,053	36,556
1944	4,903	14,562
1945	5,682	20,600
1946	12,843	50,236
1947	8,510	23,444

From Potato Div., Fruit & Vegetable Branch, Production & Marketing Administration, U. S. Dept. of Agriculture. ¹ Maine only for 1941; Maine and Idaho thereafter. Through Dec. 31, 1948 approximately 2,400,000 bu. of potatoes was ground to make about 8,250 tons of starch.

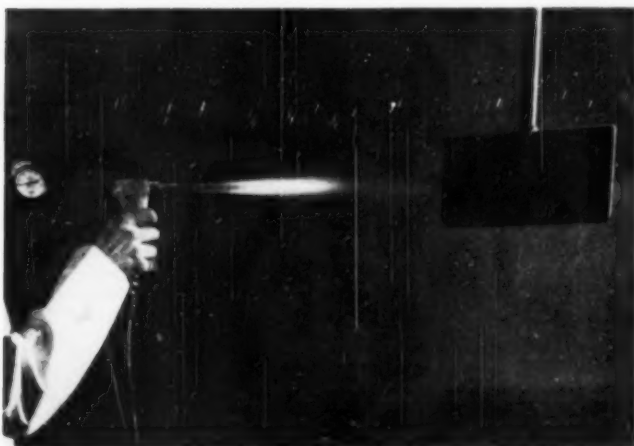
Producers of Potato Starch in the United States

Firm	Maine ¹	Plant Location	Starch Capacity, Tons per Day	Firm	Plant Location	Starch Capacity, Tons per Day
Armstrong Potato Products, Inc.		Houlton	12	New England Starch Co.	Mars Hill	8
C. A. Powers Co.		Montello	7	Northern Arrowstarch Starch Co.	Fort Kent	6
Collins Cooperative Starch Co.		Carleton	6	Osborne Starch Factory	Fort Fairfield	15
Frontier Starch Co.		Fort Fairfield	6	Prosque Isle Starch Co.	Prosque Isle	15
G. H. Page		Fort Kent	4	Valere Michaud	St. Agatha	10
Gabriel & Holt		Fort Fairfield	10			
George Philbrick		Van Buren	10			
George H. Stone & Sons		Fort Fairfield	5			
Grand Isle Starch Co.		Grand Isle	4			
Harold Mays		Limestone	6	Idaho Potato Growers, Inc.	Idaho Falls	30
Higgins & Leland, Inc.		Marietta	9	Idaho Potato Starch Co.	Blackfoot	30
Long Lake Starch Co.		St. Agatha	6	Idaho Products, Inc.	Jerome	20
Marion Starch Co.		Ashland	7	Maple Valley Processing Co.	Twin Falls	60
New England Starch Co.		Fort Fairfield	6	Minnan Starch Co.	Idaho Falls	30
New England Starch Co.		Houlton	12	St. Anthony Starch Co.	St. Anthony	30
New England Starch Co.		Limestone	6			

¹ From Maine Institute of Potato Starch Manufacturers, Inc. † Can also produce potato glucose.



New Torch Licks Problem of . . .



. . . Flame-Spraying Polythene

Since 1943, engineers have sought a way to
coat steel with polythene.

Now they've found one that gets by all the old pitfalls.

Coatings are not porous; they adhere; and
they retain all of polythene's corrosion resistance.

**W. B. De LONG and
E. V. PETERSON**

Corrosion experts were full of hope back in 1943 when the resins of polymerized ethylene first came into commercial production. Here was a material with the corrosion resistance of paraffin but with much better physical properties. It looked like a natural for lining storage tanks, drums, and other equipment where heat was not a problem but corrosion was.

But then the troubles began. Polythene (polymerized ethylene) could not be applied as a paint film from a solvent because of its virtual insolubility in liquids at ordinary temperatures. If stable emulsions were used, the article coated had to be baked afterwards to get a continuous film. Flame spraying of the polymer looked like the answer, but the sprayed coatings did not give too good results. First of all the polythene was degraded; its mechanical properties and corrosion resistance suffered. Second, there was poor adhesion to the metal surface.

Now, development of a new flame-spray gun has eliminated most of the troubles and metal surfaces can now be coated successfully with polythene. Tests of coatings applied with this technique have shown the following: Graphite-modified polythene coatings have been found porosity-free by a 30,000 volt spark test. Exposure tests of a year's duration have shown no attack on the base metal or deterioration in the coating by such acids as hydrochloric, hydrofluoric, sulphuric, and formic.

This successful preparation of polythene coatings was implemented by the development of a new flame-spraying gun, illustrated above and described below.

Preparation of continuous coatings from powder obviously requires fusion

W. B. De LONG and E. V. PETERSON are the two Du Pont engineers who developed this new torch and the special technique that goes with it. Their address: Engineering Department, E. I. du Pont de Nemours & Co., Wilmington, Del.

CORROSION TESTS ON FLAME-SPRAYED POLYTHENE

Short-Time Tests (7 days at 25 deg. C.; ASTM D-543-40)

	Conc., Wt. %	Wt. In- crease, %	Dimensional Increase, %	Appearance
Sulphuric acid	30	0.3	none	no change
Nitric acid	3	0.04	none	no change
Hydrochloric acid	10	0.05	none	no change
Acetic acid	10	-0.01	none	no change
Oleic acid	5	0.3	none	no change
Sodium hydroxide	10	1.0	0.4	no change
Ammonium hydroxide	10	0.1	none	no change
Ethyl alcohol	1	-0.01	none	no change
Antenn.	10	0.2	none	no change
Ethyl acetate	65	0.4	none	no change
Ethylene dichloride	30	0.2	none	no change
Carbon tetrachloride	2.0	0.4	no change	no change
Toluene	7.0	0.9	no change	no change
Gasoline	15.0	2.0	no change	no change
Sodium chloride	60.0	7.0	no change	no change
Sodium carbonate	29.0	5.0	no change	no change
Hydrogen peroxide	7.0	0.6	no change	no change
Distilled water	10.0	6.1	no change	no change
	2	0.01	no change	no change
	3	0.05	no change	no change
	...	0.07	no change	no change

Long-Time Tests (Reagent held in steel saucers used with flame-sprayed polythene)

	Conc., Wt. %	Temp., Deg. F.	Months Exposed	Results
Hydrochloric acid	37	70	13	no change
	37	140	9	no change
	10	70	13	no change
Sulphuric acid	85.5	70	13	no change
	40	140	8	no change
	10	70	13	no change
Nitric acid	65	70	1	failure
	10	70	13	no change
Hydrofluoric acid	25	70	13	no change
Acetic acid	90.5	70	13	no change
	99.5	70	7	failure
	99.5	140	1	failure
	10	70	13	no change
Formic acid	30	70	13	no change
	90	140	9	no change
Ferric chloride	10	70	13	no change
	10	140	9	no change
Sodium hydroxide	70	70	13	no change
Sodium chloride	50'd	70	13	no change
Formaldehyde	37	70	13	no change
Weather	..	..	8	no change

Flame-sprayed coatings pass corrosion tests.
Thanks to new torch design, polythene's excellent resistance is not lessened in process of spraying

in order (1) to "wet" the target surface, and (2) to coalesce the particles into a continuous film. It is necessary, therefore, to adjust the conditions of heating to those necessary to raise the particles to their melting point, but not seriously beyond, and to maintain them at this temperature for sufficient time to permit coalescence.

Early experimental work with flame-spraying guns designed for metal powders proved that the flame was too hot and short to secure melting without degradation. Experiments on heating polythene particles by dropping them

through heated tubes indicated that the heating time necessary for melting at temperatures sufficiently low to avoid degradation was considerably more than could be obtained in projecting them from a gun in a flame or heated gas stream. Efforts toward devising a technique which would give a stream of completely melted particles were therefore abandoned, and attention was given to the pre-heating of the particles in transit, followed by melting in place on the target surface.

This was accomplished by using a

spray gun in which the flame was relatively long and low in temperature, compared to those of conventional metal-spraying guns. It consists essentially of a venturi for drawing a mixture of polythene particles suspended in air into the gun, a tube for expelling the mixture from the gun, and a larger concentric tube for carrying the fuel gas. A flame that is lower in temperature and greater in length than those produced by most spray torches is obtained by mixing the fuel gas and combustion air beyond the torch nozzle, rather than by premixing them. Both city gas and acetylene have been used satisfactorily.

TORCH DETAILS

The sketch illustrates details of the gun construction. Air for the venturi is supplied by the tube on the far right, and the air-powder mixture by the line second from the left. Fuel gas enters by the line first from the left and is expelled through the gas nozzle. The gas nozzle is a concentric tube around the powder nozzle, the powder nozzle carries the air-powder mixture. Valves are provided on the gas and air lines for regulating the volume of gas and for controlling the velocity of the air-powder mixture. A suction relief port and closure are provided for on-and-off control of the powder flow. The air-powder mixture may be supplied by any means that will produce a cloud of polythene particles suspended in air. A commercial carburetor type feeder which requires only a small amount of air at low pressure has been used for this purpose. When it is desired to operate the gun without feeding powder, as during preheating, the carburetor air supply is simply bypassed through the soft rubber line. The pinch valve is provided for closing the bypass and building up the pressure required to make the carburetor function. This action is accomplished with the simultaneous movement of the suction relief port closure when the control trigger is operated.

Adjustments in the powder feed rate can be made by means of regulating the air pressure delivered to the carburetor. The valve in the air line connection cannot be used without altering the flame characteristics.

ADHESION

The adhesion of flame-sprayed polythene films to metallic surfaces is governed first by the same considerations that apply to most surface coatings. The target surface must be clean and free of grease, dirt, or foreign material. Sandblasting is a reliable means of cleaning metal surfaces and at the

same time roughens them so that the coating is more effectively keyed in place mechanically. In addition, it has been found that preheating the target surface to 400-500 deg. F. is necessary. Because it is not possible to produce a stream of completely molten undegraded polythene particles, some of the heat of melting must be supplied by the target in order to achieve fusion and coalescence of the individual particles into a continuous film. Further, polythene at its melting temperature or slightly above is quite viscous so that it is necessary to hold it at these temperatures an appreciable amount of time before flattening and coalescence of the particles can take place. Preheating of the target provides a heat reservoir necessary to complete melting on the target surface and is essential for good adhesion.

Even with preheating, however, flame-sprayed unmodified polythene coatings do not adhere well to metal surfaces if they are allowed to air-cool following deposition. It is interesting to note that water-quenching of coated surfaces from the melt affords excellent adhesion. It is believed although not proved, that this behavior is the result of differences in crystallization phenomena that are obtained by the two methods of freezing and cooling to room temperature. In any case, water-quenching is not a practical procedure for any but small articles.

MODIFIERS

Several modifiers have been found which, when added to polythene powder in small amounts, improve the adhesion of flame-sprayed polythene coatings to metal surfaces even when air-cooled. Of the materials evaluated, finely powdered graphite or carbon black mechanically mixed with -60 mesh polythene powder in quantities of approximately 0.5 percent were found to be the most effective. No explanation was developed to account for this behavior, although their effect on the crystallization of the melt on freezing is again felt to be responsible; other inert modifiers were only partially effective. Preheating is still required.

No satisfactory method for the quantitative measurement of the degree of adhesion of flame-sprayed coatings to metal surfaces has been worked out. In this work, adhesion was evaluated by attempting to pull a strip of the coating free of the base material by hand. Two parallel cuts, several inches in length, were made in the coating and the material between them undercut to form a strip approximately $\frac{1}{2}$ x 1 in. for a finger hold. Adhesion is not considered to be satis-

factory if it is possible to strip the coating before it breaks in tension.

APPLICATION TECHNIQUE

Preheating may be carried out either with the flame-spraying gun or with other torches, depending upon the size and shape of the part to be spray-coated. The gun is handled and the coatings applied in much the same manner as in spray-painting. An area approximately 2 x 5 ft. is covered at a time by a series of overlapping strips, approximately 2 in. wide, which are applied in a continuous manner at a torch traverse speed of 0.5-2 fps. Immediately upon completion of one pass over the whole area, another one is made, starting at the original point and proceeding in the same direction until the desired thickness is built up. Flames 8-12 in. long are used and the gun held so that the target is approximately 2 in. from the tip of the flame. Using this technique, coatings 0.040 in. thick can be applied at approximately 16 sq. ft. per hr. In carrying out this procedure, it will be observed that most of the particles still appear unmelted immediately upon striking the target, but that they fuse down and lose their identity after having been deposited in place. This lag represents the time necessary for complete melting and fusion of the new material with the adjacent particles and substrate. The heat applied with each pass is sufficient to maintain the target at the desired temperature level so that once started it is not necessary to reheat when areas of 4-6 sq. ft. are sprayed at once.

On smaller areas, sufficient time for fusion must be allowed between coats, and larger areas cannot be handled without additional heating, which is not only inconvenient but adds the danger of local overheating. Upon arriving at the desired thickness, the coating can be "glazed" or "polished" by passing the gun over it in the same manner as in spraying, but without powder addition. Care must be exercised not to heat the coating so much that it smokes appreciably or bursts into flames. The edges of the area which will be bounded by additional areas should not be glazed and should be faded down to zero thickness over a distance of approximately 2-3 in. in order to allow essentially flat joints. The "pebbly" surface in this area assists in securing adhesion to subsequent coats.

Lap joints encountered between individually sprayed areas and in the repair of damaged spots can be prepared by essentially the same technique as that above. It is advisable to spray as much of a given surface as

possible in a single operation so that the preheat will not be lost and can be carried from one section to another. When it is necessary to allow the target to cool to room temperature, as at the end of a day's work or in repairing spots in completed coatings, care during subsequent preheating is necessary to avoid overheating the material already applied. A portable shield to protect the coating from the preheating flame has been found useful. These same shields of sheet asbestos, although not necessary, have been found useful at the edges of bare target areas adjacent to those being sprayed to protect the unpreheated surface from being splattered with stray particles from the gun. These particles, if numerous, can hinder adhesion of the coating in uncompleted areas by their degradation during preheating. Small repair patches should first be stripped back to clean metal and the surrounding coating roughened with a scraper to promote better mechanical adhesion to the patching deposit. Experience to date has been limited to surfaces of approximately 25 sq. ft., but there does not appear to be any reason why this technique should not be applicable to larger ones.

CORROSION TESTS

Exposure tests have shown that flame-sprayed polythene has essentially the same resistance to chemical attack as molded or extruded material. Saucer-shaped steel vessels, approximately 8 in. in diameter, were lined with flame-sprayed polythene in order to avoid the difficulties of sealing the square edges of small test panels. These dishes were filled with the desired reagents and the coatings visually inspected throughout several months' exposure. Further tests of short duration were carried out by exposing small strips of material prepared by the standard technique in a variety of media (as outlined in ASTM D-543-43) to characterize the resistance of flame-sprayed polythene to typical classes of reagents. The results of these tests are given in the table.

The spraying technique described above permits the realization of the corrosion resistance of polythene as a coating on process equipment. By the addition of a small amount of graphite to the polythene, preheating of the target to 400-500 deg. F., and the use of a gun which utilizes a softer flame than is customary with metal-spraying guns, polythene coatings that are essentially undegraded, impervious, and which have good adhesion to steel, can be deposited. This method is believed to be a practical one that should find application in industry.

Editorial Viewpoints

SIDNEY D. KIRKPATRICK and Staff

Painful Progress

Some of the process industries are making real progress in adjusting themselves to the changing conditions of a buyers' market. Production has been cut back, prices reduced, and inventories again brought under control. Simultaneously, an all-out effort has been made to increase efficiency in both production and distribution. This, after all, is the most basic of all the corrections now under way. Not until we can reduce costs through greater productivity will it be possible to make material reduction in prices and at the same time maintain a safe position on profits and working capital.

Net income for 43 leading chemical corporations reported by the National City Bank of New York shows a gain of 12.6 percent for the first quarter of 1949 over the corresponding period of 1948. But this also represents a drop of 12 percent from the last quarter of last year—indicative of the sharp declines in commodity prices and the increasing cutbacks in production.

The trend for the next few months will depend on the success of all our efforts to bring about better balance of costs and prices, production and consumption.

A Valuable Exchange

Once again this summer a group of young economics teachers are going to learn about business first-hand. The medium will be the second annual College-Business Exchange Program, sponsored by the Foundation for Economic Education, Inc., of Irvington-on-Hudson, New York.

As the foundation puts it, "Many teachers of economics have moved directly from their undergraduate and graduate academic training into the teaching profession without the opportunity for first-hand, on-the-job experience in business. However thorough may have been their training in business theory, they find it difficult, if not impossible, to get the 'feel' of business, to understand how businessmen react to certain situations, and to understand their points of view, unless they have had the opportunity of coming face to face with these problems."

In the past we have commented editorially more than once about the necessity of academic personnel having an intimate knowledge of the business world. We have congratulated Monsanto, for example, on its

program of bringing professors of chemistry and chemical engineering into its plants. Now we are pleased to congratulate Monsanto (again), Firestone, and Du Pont for participating in this broader program. Over the years there have been too many college professors of economics with theories about government and business that, at the least, could be called "fuzzy." There might be fewer such professors if they knew business by experience rather than from books. Expansion of the foundation's program should receive the wholehearted cooperation of companies in the chemical process industries.

Holy Dwellings

Dedication on May 24th of the great new research center of Johns-Manville—the largest in the world devoted to building materials—reminded us of some famous words of Curie and Pasteur. They were used when the Curie Institute was dedicated in Paris 35 years ago.

On that occasion some one recalled that when Pierre Curie had been notified that the government of France wished to confer upon him the Legion of Honor, the great scientist replied, "Tell the Minister that I do not care for a decoration, but I do have the greatest need for a laboratory." So does the building industry!

For Pasteur's classical remarks we are indebted to Major-General E. O. Thompson, the famous Texan, who spoke recently at the Clark Bros. Co. demonstration and test of Carthage Hydrocol oxygen equipment for the new synthetic fuels plant down in Brownsville, Tex.

"If the conquests useful to humanity touch your heart, if you stand amazed before the surprising effects of electric telegraphy, the daguerreotype, anesthesia and so many other admirable discoveries; if you are jealous of the part your country can claim in the further flowering of these wonders, take an interest, I urge upon you, in these holy dwellings to which the expressive name of laboratories is given. Ask that they be multiplied and adorned. They are the temples of the future, of wealth and well-being. It is here in such laboratories as these that humanity grows bigger, strengthens and betters itself. It learns there to read in the works of nature, works of progress and universal harmony, whereas humanity's own works are too often those of barbarity, fanaticism and destruction."



Jack V. Hightower



John R. Callahan



James A. Lee

New Editorial Duties and Responsibilities

As announced in these pages last month, our editor, Sidney D. Kirkpatrick will shortly assume in addition to his present title that of Vice-President and Director of the McGraw-Hill Book Co. He will serve as director of editorial development as well as consulting editor for its chemical engineering series of texts and reference books—a position he has held since 1930. He will also continue to direct the editorial policies and program of this magazine, of which he has been editor since 1928.

John R. Callahan, who has been in charge of our editorial activities on the West Coast, is returning to New York to become Executive Editor. He will be the administrative officer of the editorial staff, responsible to Mr. Kirkpatrick and me for the editorial content and program of this publication. Mr. Callahan came to McGraw-Hill in February 1941 from the General Chemical Co., which he had served in various chemical engineering capacities since his graduation from the University of South Carolina in 1933. In January 1946 he was assigned to our San Francisco offices to help in establishing our Pacific

Process Industries Section which is playing an important part in the chemical development of the 11 Western States.

Jack V. Hightower has been appointed Pacific Coast Editor, with staff rank as Associate Editor. He joined the staff in May 1945 as Assistant Editor in our Washington office, following wartime service with the Petroleum Administrator. He was transferred to Houston in April 1947 to open a new office as our Southwestern Editor. A graduate chemical engineer from the University of Texas in the Class of 1925, Mr. Hightower brings to his new position a background of experience in engineering and journalism.

James A. Lee is to be the new Southwestern Editor of *Chemical Engineering* and Manager of the McGraw-Hill News Bureau in Houston. During the twenty years he has been associated with this magazine he has been closely concerned with the development of the process industries in the South and Southwest. His many regional reports and plant articles have contributed materially to their remarkable progress. A native of Weeks Island, La., Mr. Lee's broad knowl-



Sidney D. Kirkpatrick

ledge and intimate acquaintances among industrial leaders, engineers and technical men in the chemical, electrochemical, pulp and paper and petroleum industries will open new opportunities for editorial service on this rapidly growing frontier of our chemical economy.

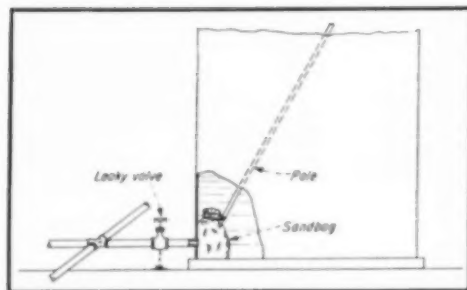
These changes in editorial assignments and responsibilities will, I am sure, help us in meeting the challenging needs of the chemical engineering profession. We are proud of the record of our editorial staff—by far the largest and most experienced group of chemical engineers serving any publication in our field.

M. A. Williamson

VICE-PRESIDENT AND PUBLISHER

The Plant Notebook

THEODORE R. OLIVE, Associate Editor



How to Plug a Tank Outlet For Emergency Repairs

D. H. LAWRENCE, General Foreman, E. I. du Pont de Nemours & Co., Niagara Falls, N. Y.

★ March Contest Prize Winner

A sandbag can often be used to blank off the discharge line from a storage tank when minor repairs to the outlet line must be made, or the outlet valve is to be changed. This is a kink that I have found very useful in maintenance work, but it must be emphasized that careful thought must be given to safety and procedure before using it.

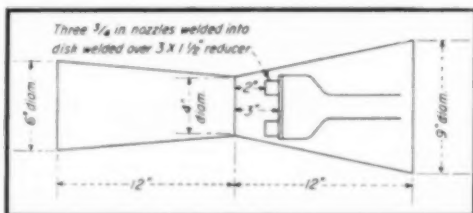
It is necessary first to go over the job with the men who are to do it, explaining the hazards and the safety measures that must be observed. I point out that the sandbag plug is good only for a short time, depending on the material that is in the tank.

I have used this method satisfactorily and safely on the repair of HCl storage tanks. The plug is prepared by putting one burlap bag inside another and filling the inner bag with about 25 lb. of sand. Other bag materials may be better for some purposes. (For example, plastic sheeting or a discarded rubber raincoat or oilskin slicker might be better for some purposes.—Editor.) The bag is then wired securely to the end of a pole long enough to reach the bottom of the tank.

To use the plug it is lowered into the tank and worked into place over the nozzle connection inside the tank. Before the line is opened it must be tested at some suitable

point to make sure the plug is effective. Needless to say, the men doing the job must wear safety clothing and goggles if the tank contents are dangerous. They must work fast, since the plug may not hold long. As soon as the repair is finished the sandbag is removed by means of the pole.

Although the method may be a lifesaver in a good many cases, it cannot be denied that other methods may be safer. So the sandbag plug is only used if for any reason the tank cannot be emptied readily for making minor repairs on a bottom discharge connection.



Efficient Agitator Operates on Low Pressure Steam

A. W. LLOYD, Chemical Engineer, Grays, Essex, England

It sometimes happens that a tank must be used for a purpose other than the one for which it was originally designed, and that agitation becomes a problem. We were faced with such a situation in dissolving an anhydrous salt which hydrated immediately in contact with water, forming lumps. It was to be dissolved in an underground horizontal tank and it was necessary for the final concentration to be closely controlled near the saturation point. At first we tried agitation with air from an 55-hp. compressor, plus a vertical propeller agitator consuming 12.5 hp. The arrangement was never entirely satisfactory and the agitator gave continual trouble owing to shaft whip.

Steam at 10 psig. was available at the tank, since it had once been provided with a closed heating coil. We decided therefore to design a steam operated agitator of the circulator type and the design illustrated proved to be most

★MAY PRIZE WINNER—A \$50 prize will be issued to...

HOWARD H. FOX

Mechanical Engineer, Buffalo Process Equipment Co., Buffalo 20, N. Y.
... for an article describing a recording gravimeter for viscous liquids which is highly precise and offers freedom from the usual troubles with such equipment. This article has been judged the winner of our May Plant Notebook contest, and will be published in our July issue.

\$50 PRIZE FOR A GOOD IDEA—Until further notice the Editors of *Chemical*

Engineering will award \$50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook.

The winner each month will be announced in the issue of the next month, e.g., the June winner will be announced in July and his article published in August. Judges will be the editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published if acceptable at our usual space rates.

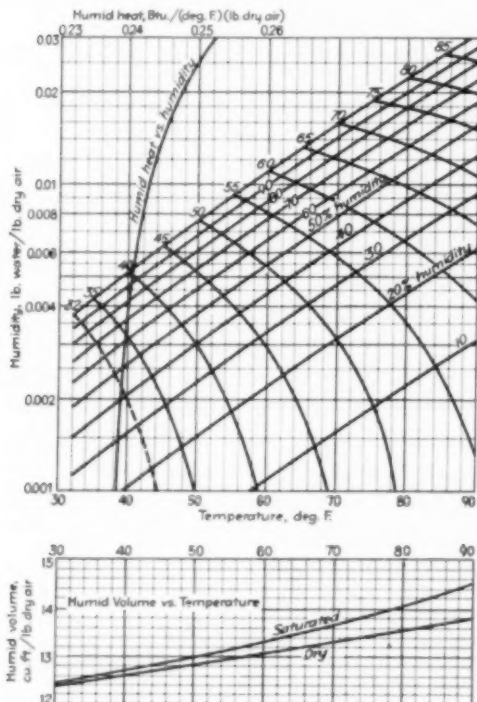
HOW TO ENTER CONTEST—Any reader of *Chemical Engineering*, other

than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Articles may deal with any sort of plant or production "kink" or short-cut that will be of interest to chemical engineers or others in the process industries.

Also, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

effective, enabling us to dispense with the 85-hp. compressor and leading as well to other advantages in reduced maintenance, quicker processing, closer solution control and lower operating costs.

Since the dimensions of the circulator are fairly critical, they are given in the accompanying drawing. The device is cheap and simple and consists of two frustrums of cones of $\frac{1}{8}$ -in. sheet, welded together at the smaller ends. The jet unit comprises a $1\frac{1}{2}$ -in. supply line enlarged to 3 in., over the face of which a disk drilled with three holes is welded. Three $\frac{1}{4}$ -in. nozzles are welded over these holes. Two small webs between the jet supply line and the outer shroud locate the jet centrally in the shroud and facilitate installation on the tank bottom. In operation, with a head of 5 ft. of solution at 170 deg. F. over the agitator, it consumes about 300 lb. of 10 psig. steam per hour.



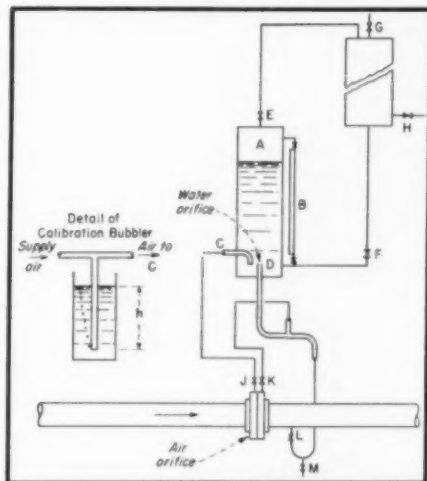
Low Range Humidity Chart Improved by Replotting

D. S. DAVIS, Department of Chemical Engineering, Virginia Polytechnic Institute, Blacksburg, Va.

Usual natural-scale humidity charts are difficult to read in the area of low temperatures and low humidities. Semi-logarithmic plotting using a semi-logarithmic scale for humidity and a natural scale for dry bulb temperature (as in the chart above) expands the low ranges and permits easy reading, even though such plotting throws the saturation lines into definite curves.

This chart is based on Equations (118), (119), (120) and (131) in the second edition of Badger and McCabe's

"Elements of Chemical Engineering." It permits close and easy estimation of humidities, humid heats and humidity volumes on the basis of 1 lb. of dry air. Since it is used in the same way as standard humidity charts, it needs no particular explanation.



Direct Acting Controller Humidifies Compressed Air Stream

F. CARR, Sarnia, Ont., Canada

We had a problem of accurate humidification of a varying air stream at 100 psi. pressure which was solved satisfactorily by the direct acting ratio flow controller described here. Although the controller requires no conventional air operated equipment and needs no pump for the humidifying water, it controls the small water flow accurately and in proper proportion to the air flow, regardless of variations in the flow rate.

The controller operates from the differential pressure created by an orifice in the main air line. This differential depends on various constants, including the orifice diameter and is directly proportional to the square of the air flow rate. Its magnitude can readily be calculated from information given in standard chemical engineering texts. The differential head is imposed on a small orifice which controls the water flow rate. Since the head and flow rate of the water orifice are governed by the same square law as the air orifice, the water flow rate will be directly proportional to the air flow rate and constant humidification will be obtained.

The diagram shows just how this principle is applied. The air line orifice is installed with two taps, J and K. A pot A is made up of pipe and fitted with a gage glass B. The high pressure tap J is connected to nozzle C which is turned down inside the pot A and bevelled off to a sharp level edge at the level of water orifice D. The low pressure tap K is connected back to the nozzle which contains orifice D. The water orifice D is a thin stainless steel plate which is drilled for the orifice and calibrated as later described. The pipe from D discharges through a loop seal into the air line at L, thus carrying the controlled water stream into the air line.

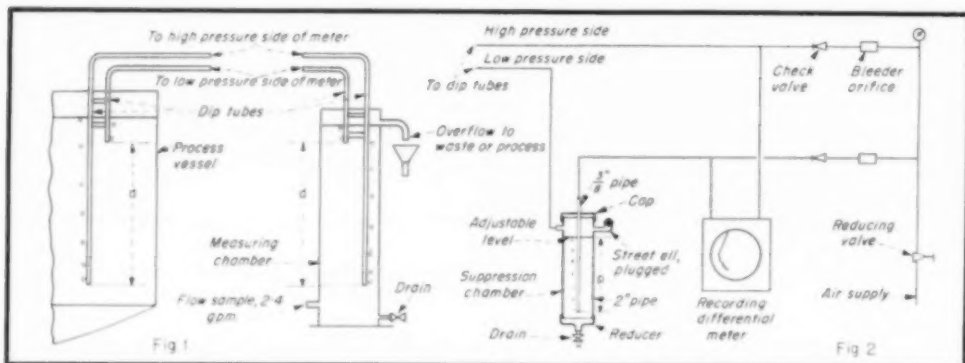
A second pot above the first, and connected to it by valved lines *E* and *F*, is provided for filling *A* only if the system is to be in continuous operation for long periods. It has a vent *G* and a filling connection *H*. Pot *A* can be refilled from the upper pot without disturbance by closing *G* and *H*, then opening first *E*, then *F*. The upper pot is refilled with *E* and *F* closed and *G* open.

The orifices are designed by first calculating the required sizes. The equipment is set up with the water orifice drilled to the calculated size, but it will require calibration for accuracy since the discharge coefficients for small orifices are somewhat unreliable. Calibration is accomplished by filling *A* with water and disconnecting *J* and *K*, leaving *K* open so that the downstream pressure on the water orifice will be atmospheric. The upstream pressure on the water orifice is held constant by bubbling water into *A* through *C* at a constant pressure, using for this purpose an external bubbler tube shown at the left of the diagram. The head *h* on the bubbler is the average head value at

which the water orifice is to be calibrated. By measuring the water discharged at *M* over a period of time, the flow rate through the orifice can be found and the orifice diameter can then be corrected if necessary.

To start the controller in operation, close valves *J*, *K* and *L*, open vent *G* and fill both pots with water through *H*. Close *E* and *F* and open valve *K* to bring the pot to air line pressure. Drain the loop seal through *M* and then open valves *J* and *L*.

As water drains out of pot *A* it is replaced by air bubbling under the sharp edge of nozzle *C*. Thus the pressure in *A* at the level of *C* and of the water orifice *D* is equal to the upstream pressure at the air orifice. At the same time, the open connection from the outlet pipe from *D* to the downstream side of the air orifice holds the pressure below *D* equal to the downstream air pressure. Hence the pressure differential across *D* always equals that across the air orifice so that the water flow rate will always be proportional to the air flow rate.



Continuous Specific Gravity Recording By the Air Bubble Method

M. M. FROMM, Engineer, Pittsburgh, Pa.

Continuous measurement of the specific gravity of a liquid is often important in the control of a chemical process. The ordinary differential type meter used for flow recording is easily adapted to specific gravity applications.

The air bubble method is used to measure specific gravity by weighing a constant height of the liquid. Two dip tubes are introduced into either a process vessel, or a measuring chamber through which a sample is circulated. The distance *d* between the bottom of the tubes must be permanently fixed, as in Fig. 1. The piping from the dip tubes to the differential recorder is shown in Fig. 2. All connections must be absolutely tight. The dip tubes should be 1/2 in. std. pipe, and the connections 1/2 in. copper tubing.

The bleeder orifice shown in Fig. 2 is a flow restriction, such as a short length of capillary tubing, passing 1-2 cfm. A needle valve bubbler combination is not satisfactory. The reduced air pressure should be set about 15 psi. higher than the pressure at the dip tubes, though this adjustment is not critical. The suppression chamber on the low pressure side of the meter suppresses the initial differential pressure produced by the dip tubes.

To design a system for a particular installation, two equations are required. Their derivation will not be given:

$$d = h/y \quad (1)$$

$$P = ds_s - h/2 \quad (2)$$

where *P* is the height of liquid in the suppression chamber, inches of water; *d* is the height between dip tubes, inches; *s_s* is the specific gravity corresponding to the center or midpoint of the meter range; *h* is the differential range of the meter, inches of water; and *y* is the specific gravity range of the meter.

As an example, it is desired to record the specific gravity from 0.75 to 1.25 on a meter with a differential of 20 in. of water. Then *h* = 20; *y* = 1.25 - 0.75 = 0.50; *s_s* = 1.00; *d* = 20/0.5 = 40 in. between dip tubes; and *P* = 40 × 1.00 - 20/2 = 30 in. of water or 2.21 in. of Hg.

If a meter with a 10 in. differential range were to be used, then *d* = 20, and *P* = 15 in. of water.

One type of suppression chamber is sketched in Fig. 2. The liquid used—mercury or non-volatile organic fluid—is poured in through the filling elbow, which is then plugged. The chamber is filled to a height greater than calculated. The air bubble system is started and the actual specific gravity measured by hydrometer. Fluid is then drained from the suppression chamber until the meter reads the correct gravity.

Using a recorder chart graduated 0 to 100, with 100 graduations, a calibration between chart reading and specific gravity can easily be constructed on linear coordinate graph paper.

Correction—Due to a transcription error the metric-to-English conversion system described by H. Richardson on p. 157 of our May 1949 issue was incorrectly stated. The ounce-mol should be 22.438 cu. ft., not liters.



LEATHER INDUSTRY

The battle between leather and plastics is on. Rising costs and competition from plastic films are forcing producers to find new ways to make leather cheaper and better. No tanner has illusions about the prompt return of easy profits. However, good leathers have a permanent place in our economy. How big that place will be may be decided in the next few years.

CHEMICAL ENGINEERING REPORT — JUNE 1949

PROBLEMS of the tanners have created intense interest in the chemical industry. Chemical firms have a dual stake in the result. Leather is a big consumer of chemicals. So is the plastics industry. To see what the tanners are doing about the current situation, the Chemical Market Research Association held a symposium. Authorities discussed tanning improvements, chemical requirements of the industry, leather's part in national defense, and the growth of plastics competition in leather markets.

CMRA
stirs up
interest

In introducing the subject to the members at the St. Louis meeting, Richard M. Lawrence, program chairman, said that one of the oldest and steadiest customers of the chemical industry is leather tanning. It ranks about twelfth among industrial markets for chemicals. Situations up-

stream and downstream from the leather tannery are ominous. The raw materials picture shows a serious shortage of tanning agents.

In the marketplace leather is now feeling the full impact of synthetic rubber and plastic replacements. They have already replaced heavy leather in one out of every three pairs of shoes made. He said that this battle of the century between leather and synthetic replacements will grow to still more vast proportions within the next ten years. Mr. Lawrence pointed out that there were no more interested observers than members of the progressive profession of market research.

Synthetics
make
inroads

Military significance of the leather tanning situation is being presented by Col. Kennedy. Character and extent of the tannery market for

chemicals will be discussed by Flinn and Bell. The process weapons with which the leather tannery will stand and fight back are to be discussed by Mr. Winheim.

The heavy artillery of the rubber and plastic companies used in capturing a huge share of the great leather market will be described by Mr. Hoover.



Tanning—Today and Tomorrow

"... Science will play an increasingly important role in the battle between the laboratory and nature in providing leather-making materials."

A. H. WINHEIM President, Planetary Chemical Co., Creve Coeur, Mo.
President, American Leather Chemists Assn.

The antiquity of the art of tanning is unquestioned. Its origin predates recorded history. Today, by the application of sound chemical and engineering principles, tanning is attaining a new vitality and envisions products possessing a controlled variability. Tomorrow, new leathers—durable leathers bridging the gap between plastics and the leathers of yesteryear—will find expanded and new fields.

Basic
problem:
no two
hides
alike

The basic raw material of the tanner has always been hides—packing house byproducts varying in size, shape, thickness, texture and condition. Hides come from all parts of the world, from animals of every breed, sex and age—literally no two alike. From these hides, with the aid of such widely-varying substances as extracts from natural plant life, uniform products have been sought. The extreme variability of the hide or skin has made uniformity of operation an ideal rather than an actuality.

The commercial tanner of today employs one or more of the proved types of tannage: vegetable (pyrogallols and catechols), chrome, other mineral tannages, formaldehyde, oil and syntans.

Hide has
three
layers

All animal hides are divided sharply into three layers, each distinct in structures: (1) a thin outer layer of epithelial tissue, the epidermis; (2) a much thicker layer of fibrillar and connective tissue—the true skin or corium, and (3) a thin layer containing adipose, and loose connective tissues—the "flesh." Only the corium is utilized in the production of leather.

As removed from the animal, a hide is covered with bacteria and will readily putrefy. Commercially, hides are preserved or "cured" by packing them in salt.

The salt-cured stock is trimmed, the removed appendages being used in the preparation of glue and gelatin. One of the most important phases of hide treatment takes place in the beam-house, where it is processed for two to ten days. The first of these refining operations consists in washing the skins with cold water to remove salt, dirt and blood, and to partially dehydrate the tissues. The flesh is then removed by a machine equipped with a spiral-bladed cylinder.

The important unhairing step follows. The hair is removed and the hide is "opened up" by treatment with mild alkaline dipilants. Un-

hairing may also be accomplished by treating the soaked skin with certain enzymes or by "sweating," in which case the soaked skin is hung in a warm humid room until the ever present proteolytic bacteria have digested the epidermis. The great bulk of all skins, however, are unhairing by "liming" with a saturated solution of calcium hydroxide with accelerators.

Although this pretannage treatment with alkali acts on the basic fabric of the skin to loosen the fibrous structure, as well as to destroy the epidermis in which the hair is embedded, and to partially saponify the skin fats, it does not loosen the fibers sufficiently to produce a soft and pliant leather. Bating is necessary to accomplish this.

The older processes of bating tended to neutralize the lime and, also, to bring the collagen into a flaccid or unswollen condition. By "older processes of bating," reference is made to the employment of fermented pigeon dung and dog dung as bating materials in tanneries.

Bating
has
changed

But a man named James Turney Wood changed all this in 1907. As a result, today, instead of depending on malodorous fermenting dung to obtain the resultant enzymes, tanners use mixtures of ammonium chloride and the proteolytic enzyme extracted from the pancreatic gland of cattle.

Subjecting untanned, dehaired skins to the action of enzymatic bates removes the undesirable skin constituents (non-leather formers). At the same time, some of the peptide linkages of the hide proteins are split, influencing the character of the finished leather.

Usually, bating and deliming are effected simultaneously by incorporating an ammonium salt in the bating compound. This ammonium salt acts both as a deliming agent and as an activator for the proteolytic enzyme.

Later similar enzymes produced from certain fungus growths made their appearance. They are successfully employed as tannery bates.

The tanner has developed two basic techniques for obtaining diversity of character in finished leather. In one, he loosens the weave of fibers by destroying and washing out some of the skin substance. In the other, he adds finely divided material to fill the voids between the fibers, imparting to the tanned hide, body

and stiffness as well as increased thickness. These two techniques divide all tanning into two main categories: the production of light leather and production of heavy leather.

Heavy leather is thick, stiff and capable of little stretch. If intended for shoe soles, it should also be resistant to abrasion and moisture penetration. For belting, it should have strength and the ability to withstand repeated flexing.

Light leather, on the other hand, is produced by techniques which emphasize the unique appearance of the product, other requisites being flexibility and strength.

Tanning
makes
leather

The principal object of tanning is to make the hide resistant to water, bacterial attack and wear. In general, it is desirable also to impart to the finished leather high tensile strength, pliability and the capacity to maintain when dry a shape given it when wet.

The leather-forming proteins combine both with acids and with alkalis. One might conjecture, therefore, that there are a large number of tanning agents. Experience shows, however, that although many chemical compounds possess the required nature, few yield good leather.

In vegetable tanning, the prepared hide is placed in an acid tannin solution (a so-called tan liquor), whereupon the hide vigorously absorbs tannin and combines with it to form leather.

The positively-charged hide and the negatively-charged tannin mutually coagulate each other. In alkaline solution, both tannin and hide are negatively charged, and no tanning occurs; in fact, leather may be stripped of tannin by alkalis.

Tanning
takes
time

This tan liquor is gradually increased in strength and astringency until after a period of days, weeks or months, the hides are said to be tanned. Incidentally, the average time required to make straight bark-tanned sole leather is 40-75 days.

The mechanism of vegetable tanning is complicated by the complexity of tannin itself and its many varieties. It is further confused by the presence of other equally complicated chemical entities found in the same plants together with the tannins. These associated materials (non-tans), while not classed as tans, play an important part in determining the physical properties of the resultant leather. Non-tannins play the role of protectors to the tannins, and the general rule is that tanning liquors having the highest non-tannin to tannin ratio are the least astringent.

Just as the bulk of all heavy hides are converted into leather by means of vegetable (or bark) tanning, so the bulk of all light hides and skins are made into leather by means of mineral tanning.

When the alum tannage is used in the production of pure white leathers and in dressing fur skins, the tanner carefully controls the pH, the neutral salt concentration and the added organic complexes in his tanning solutions of basic aluminum chloride. The water absorbency and poor weathering characteristics of alum-tanned leathers, however, have limited their production.

Today's widely used chrome tannage is a gradual development from the original process intro-

duced by the chemist, August Schultz, in 1884.

The Schultz tannage became known as the two-bath chrome process. Later, Martin Dennis patented a process for tanning skins directly in a solution of basic chromium sulphate—the real beginning of the chrome tanning era. Today, more than 90 percent of all shoe upper leather is tanned by this "one-bath process."

When skins are chrome tanned commercially, they are first pickled, the process consisting of treating the skins with acid and sodium chloride. The pickled stock is agitated in a solution of basic chromium sulphate until tannage is effected. The chrome tanning process is much more rapid than vegetable tanning. Many light leathers are fully tanned in a few hours. Chrome-tanned leather is treated with a milk alkaline solution ("neutralized") to remove any unbound or free acid that may be present.

Chrome
tanning
improved

Among the many factors affecting the properties of chrome liquors and their reaction with pelt are: (1) pH value; (2) neutral salt content—kind and amount; (3) nature of acid radicals (sulphates have greater tendency than chlorides to enter chrome complex, and organic acid radicals more than either); (4) colloidal character; (5) presence and nature of chrome complexes ("masking agents").

Formaldehyde is successfully employed in the tannage of white leathers and in the retannage of chrome- and alum-tanned leathers. This retannage yields a leather of increased structural stability displaying a marked increase in shrinkage temperature. It is handicapped, however, by its hydrophylic nature.

Oil or chamois tannage produces an exceedingly supple leather and is a common means of preserving fur skins. The pelts are impregnated with oxidizable oils such as cod liver oil or seal oil, which subsequently undergo controlled oxidation. Chamois, buckskin and sealskin are processed by this method.

Various combinations of the conventional tannages are employed by tanners to obtain properties not yielded by the individual types. Adjuncts to both the chrome and the vegetable processes which have encountered increasing favor are the syntans—synthetic tanning agents.

There is as yet no all-inclusive theory of vegetable tanning, and it is probable that no single theory will ever explain the many ramifications of the process. Yet, in addition to the theoretical interest and fascination of the reaction, the need for such knowledge to permit scientific control of the process, will spur on fundamental research into its intricacies. The greatly-needed organic tanning materials will not be synthesized nor new leather chemicals intelligently applied unless there exists at least a vague understanding of the mechanism of the tanning-collagen reaction.

Tanning
still
has
mysteries

The work on X-ray diffraction patterns and the electron microscope studies of collagen and leather particularly, of Highberger and Schmitt have provided valuable fundamental knowledge for the industrial research worker.

The U. S. Department of Agriculture has for many years been seeking domestic sources of tannin in trees, perennials and annual plants. The western hemlock, the spruce and the redwood of the Pacific Coast have shown some

promise, but long-distance transportation has aided other disadvantages in preventing serious commercial consideration. The button-wood and the scrub willow also offer possibilities.

High yields of tannin have been obtained from the liners of pecan shells. After considerable experimentation, a fair tannage with extracts from this industrial waste has been evolved.

Canaigre
for
tannin

Canaigre, Arizona's tuber, bids fair to become the leading domestic source of vegetable tannins. Growing wild in the arid waste lands, Canaigre develops, within two years, a root rich in tannin.

Another domestic source of tanning materials may be the wood pulp of the paper industry. Fred O'Flaherty and his associates at the Tanners Council Foundation Laboratory (University of Cincinnati) and Harry Lewis (and co-workers) at the Institute of Paper Chemistry have shown that liginosulphonates possess tanning properties under certain conditions.

Of more immediate and definite importance as future tanning materials are the replacement syntans. Following Stiasny's initial syntan, Neradol D—a formaldehyde condensation product of cresol sulphonic acid—came the naphthalene syntans. These appeared as acid or neutral liquids or solids, with varying amounts of active ingredient. To some were added acids such as oxalic or formic, or salts such as potash alum or titanium potassium oxalate, to obtain specific effects. However, none of these syntans were replacements for the natural tannins. They served merely as adjuncts, for bleaching chrome leather, as dye resists or mordants, for solubilization of vegetable tans, and for increasing the speed of penetration of the vegetable tans into the leather.

Germans
used
syntans

Germans early devoted their efforts toward improving the tanning properties of these condensation products. The replacement of benzyl-naphthalene for naphthalene yielded some improvement but did not provide the desired substitute. Use of the original syntans as dispersing and peptizing agents for phenolic resins represented a move in the right direction. The Germans found these materials satisfactory as combination tannins when they constituted 50 percent of the tannin content.

Under the name of Tanigin Extra B, the first successful replacement syntan was produced by the Germans. A phenolic resin of the Novolak type was prepared and this resin was partially sulphonated, using only about 0.45 mol. of sulphuric acid per mol. of phenol. The sulphonated product when neutralized and diluted to appropriate strength constituted the first "Aust auch gerbstoffe" (replacement tannin). Many variations followed.

In general, the sulphonic acids of the resins were prepared by direct sulphonation with acid or by treatment of the resin with sodium sulphite and formaldehyde and then used as dispersing agents for the unsulphonated resin. Another method employed treatment of the resin with lignin sulphonic acids. Some investigators feel that the lignin sulphonic acid condenses with the resin.

Rohm and Haas' "Orotan" was the first of the American replacement syntans. Others include "Chemtan" and "Intan."

A highly important study sponsored by the Quartermaster General's office has been the use of the sulphonyl chlorides of petroleum hydrocarbons as tanning agents and leather lubricants. Early in 1942, Adolf Schubert and G. W. Schultz were sent to Europe to study the German leather industry. One of their interesting reports dealt with the Immergaus and Derminols, stating that an aliphatic hydrocarbon sulphonyl chloride was used as a replacement for cod oil in tanning chamois leather and furs.

Subsequently, J. B. Brown of Ohio State prepared many compounds by the simultaneous treatment of various petroleum oils and waxes with sulphur dioxide and chlorine (Reed process). W. T. Roddy of the University of Cincinnati developed a process for utilizing these materials as tanning agents and evaluated the new materials made by Dr. Brown. Du Pont, owners of the Reed patent, now produce several of these compounds commercially.

We are
making
syntans

Mineral tannages are not being neglected. Since chrome ore is imported from Africa and the Philippines, its wartime availability may present serious difficulties. Much experimentation is currently proceeding on alum and iron tannage.

Excellent white leather has been made by use of basic zirconium sulphate. The leather possesses nearly all of the good properties of chrome-tanned stock together with the permanent, all-through whiteness. Present high costs and the import situation becloud the picture.

The so-called resin tannages are regarded as important factors in the field of future leather-making. American Cyanamid's Tanak MRX, a trimethylol melamine, has been used commercially to make white leathers of desirable character.

A resin tannage developed by Du Pont is designated G-942. This product, a copolymer of maleic anhydride and styrene, yields a durable white leather possessing extreme suppleness.

The new Duldchde-resin tannage, announced at the Washington ACS meeting last September, will be more fully disclosed at the ALCA meeting this month. Ed Doherty and the authors have survived the Patent Office fights and have devoted a portion of their time to pilot plant trials of the process. Good leather can be made and properties can be varied over wide limits.

Significant developments occurring in the technology of tanning during the past few decades include: (1) The simple and efficient method for sterilization of hides from cattle infested with foot-and-mouth disease (procedure developed by Doherty and O'Flaherty); (2) the development of sulphur hydrates as soaking assists; (3) the discovery of methylamines for unhairing hides; (4) the development of proteolytic enzymes for use in bating; (5) the development of chrome tanning, with emphasis on the very recent application of masking agents in the chrome complex; (6) the development of synthetic tanning materials, particularly those capable of replacing the vegetable tannins (such as Turley's Orotan); (7) the development of aluminum fat-liquoring agents; (8) the development of mineral oil sulphonates as leather lubricants;

Tanners
make
headway

(9) the development of methyl methacrylate and vinyl copolymer finishes.

Today's top tannages are vegetable and chrome. Of secondary importance are formaldehyde, oil and combination tannages. Economic considerations will probably determine the extent to which the tannage of tomorrow will include that unique tuber of arid Southwest,

an aliphatic hydrocarbon sulphonyl chloride, a modified mineral complex, a replacement syn-tan, a methylol melamine, a styrene-maleic anhydride copolymer or a dialdehyde and chemically-bound resin. There can be no doubt, however, that science will play an increasingly important role in the battle of laboratory and land in providing leather-making materials.

Leather Industry Is Big Chemical Consumer



E. S. FLINN Manager, Tannin Extract Div., Mead Corp., Lynchburg, Va.
K. E. BELL Vice President, A. C. Lawrence Leather Co., Peabody, Mass.

"... Heavy chemicals, better than 350 million pounds yearly, are employed for myriad uses. Profitable markets await the chemical manufacturer who operates intelligently."

Manufacture of leather from hides and skins involves a series of complicated operations which require every important group of chemicals in one product or another. Heavy chemicals, organics, synthetic resins, dyes, oils, pigments, solvents, surface active agents, enzymatic preparations and synthetic tanning materials are all important items.

Production costs emphasize that, while there has been a definite increase in manufacturing costs in the past ten years, the value of the raw hides or skins has varied between 54-60 percent of the total product value, or more than all the other items put together. Consequently, this emphasizes the need of careful operation and the use of proper materials to insure high yields of quality leather.

	Million Dollars	
	1939 (Actual)	1946-1948 (Estimated)
Raw stock	\$172.8	\$462.0
Labor	55.9	122.0
Materials	44.5	94.0
Overhead*	48.1	93.0
Total Value	\$321.3	\$771.0

*Includes interest, depreciation, taxes, sales, repairs, administrative expense and profit.

The scope and the volume of trade that the chemical industry has in the leather field is also emphasized in these figures:

	Number of Products	Chemicals Used in Leather Industry, Million Lb. Per Yr.
Heavy chemicals	31	354
Vegetable tanning agents	16	596
Other tanning agents	6	123
Oils, soaps, fat liquors	14	69
Finishes, pigments, solvents	13	46
Enzymes, syntans, moldicides	6	80
Total	86	1,258

The fact that 12-14 percent of the cost of manufacture is utilized in the consumption of chemicals emphasizes the tremendous part the chemical industry plays in the manufacture of leather. The next table shows the main categories and approximate dollar value of chemicals used by the industry comparing the year 1939 with the 1946-48 period.

	Million Dollars	
	1939 (Actual)	1946-1948 (Estimated)
Heavy chemicals	\$ 3.7	\$ 7.4
Enzyme preparations	0.4	1.2
Vegetable tanning materials	18.1	41.0
Other tanning agents	4.3	8.4
Synthetic vegetable replacements	—	0.5
Syntans and bleaches	2.5	4.5
Dyes	4.3	8.7
Oils, soaps, fat liquors	4.0	8.8
Finishes, pigments, solvents	7.1	13.0
Preservatives	0.1	0.5
	\$14.8	\$94.0

Flowsheets of typical tanning processes for upper leathers and sole leathers are given in the accompanying box. They illustrate the various chemical items, or classes of materials, employed in the different operations.

The following comments supplement the information shown in the flowsheet. The presence of iron in water or tannery chemicals results in the formation of iron tannate, or ink, in vegetable leather operations. Consequently, many chemicals must be furnished iron-free if they are to be satisfactory for industry use.

Water is the lifeblood of the tanning industry. Approximately 250 gal. of water are required for each hide processed.

Heavy chemicals, better than 350,000,000 lb. yearly, are employed for a myriad of uses. For example, formic, acetic, lactic and glycolic acids are used for controlling the acidity of the tan

Water
is
important

**Two typical processes
show variety of chemicals
used in leather industry.**

Raw Stock

SOAK—Uses water, sodium bisulfide, sodium polysulphide, surface active agents

LIME-SULPHIDE—Uses sodium sulphide (or sodium sulphhydrate), lime, dimethylamine, water

PICKLE—Uses sodium chloride, sulphuric acid, water

TAN—Uses basic chrome sulphate (or alum, syntans, zirconium) with sodium bicarbonate, borax, preservatives (trinitrophenol, pentachlorophenol, etc.), water

COLOR AND FAT LIQUOR—Uses water, dyes, mordants, surface active materials, vegetable tannins, tartar emetic, oils (fat liquors), formic acid

DRY

STAKE

FINISH—Uses casein, shellac or nitrocellulose, or polyacrylate, polyvinylchloride, urea-formaldehyde dispersions, plus pigments, oils and waxes

Finished Upper Leather

liquors, oxalic acid, sulphuric acid, sodium carbonate and borax for bleaching, while chalks, epsom salts, barium chloride and sugars are needed for weighting and filling sole leather.

Slaked lime is employed in removing hair from hides and skins. This has been supplemented in recent years by sodium sulphide, sodium sulphhydrate, dimethylamine and other "sharpening" or accelerating agents.

The nauseous dog dung mixtures have given way to enzymatic preparations, mixed with ammonium chloride or ammonium sulphate. Enzymes are derived from bacteria, fungi or extraction of pancreatic glands. Lime is removed by the ammonium salts, which also bring the pH of the bate liquor to the point of optimum enzyme activity. "The enzymes selectively dissolve certain proteins, or 'clear the grain.'"

These loom large in dollar volume and importance. Skillful blending and application of vegetable tans determine the yield, color and character of heavy leathers. Vegetable tans are prepared and sold by suppliers, while in other cases tanners leach their own. The United States supplies only 30 percent of its own requirements of tanning materials, principally chestnut oak bark, chestnut wood and hemlock bark. At the present time approximately 90 percent of the domestic tanning supply is obtained from chestnut wood. Of the 70 percent that is obtained from foreign sources the bulk

Raw Stock

SOAK—Uses water, sodium polysulphide, surface active materials

LIME-SULPHIDE—Uses calcium hydroxide, sodium sulphide (or sulphhydrate), water

BATE-DELIME—Uses enzymic preparations (pancreatic, bacterial, or fungus), water ammonium sulphate, hydrochloric, lactic, acetic acids

TAN—Uses vegetable tanning materials (quebracho, chestnut, valonia, wattle, etc.), spruce, synthetic vegetable replacements, lactic acid, glycolic acid

BLEACH—Uses sodium hydroxide, sodium carbonate, sulphuric acid, water

OIL LOAD—Uses mineral oil, sulphonated oils, spruce, corn sugar, Epsom salts, oxalic acid, borax, vegetable tannins, phenol

DRY

DRY DIP—Uses syntans, vegetable tannins, lignosulphonates, aluminum sulphate

OIL LOAD

DRY

FINISH ROLL—Uses sponging compounds, sulphonated oils, carnauba wax, casein, ammonium hydroxide

Finished Sole Leather

is quebracho from Argentina and Uruguay, with increasing amounts of wattle bark from South Africa. In smaller quantities, but nevertheless important for providing certain leather qualities, are valonia from Turkey, myrabolan nuts from India and mangrove bark from Borneo.

During the past ten years synthetic tanning materials from condensed phenol resins have proved their worth as complete replacements for certain vegetable tannins, and are in increasing commercial use today.

Chrome tan is prepared by the reduction of sodium bichromate with sugar or sulphur dioxide. Prepared chrome tans are readily available, although many tanners reduce their own liquors. Alum, formaldehyde, sulphur liquors from wood pulp production and synthetic condensation products are important supplementary items.

The term syntan applies to salts of condensation products such as naphthalene-formaldehyde, which are employed as partial tanning ingredients, mordants or bleaches. The use of these materials has increased.

Dyes are among the most expensive items used by tanners, and skillful formulation of dyes and mordants and chemical control of the operation are required if bright, even shades and colors are to result.

Most tanners purchase prepared trade-name blends of oils for the lubrication of their leathers.

**Dyes
are big
factors**

**Worst
odors
gone**

**Our
vegetable
tans are
scarce**

A few blend and sulphonate their own. Proper formulation ensures correct lubrication without impregnation of the leather. The curtailment of supply of coconut oil and sperm oil disrupted the normal supply of sulphated oils during the war. Most of the established materials are now available again and, in addition, many synthetic or reconstituted materials. Oils or "fat liquors" for acidic leathers are comparatively newcomers in the field. Sulphonyl chloride type materials, made in this country from straight chain hydrocarbons, are available on a development basis and, indeed, one of the analogues is offered as a synthetic tanning material.

Leather must withstand repeated flexings, abrasion, exposure to sunshine and often to rain. In most cases eye appeal is important, so that proper choice of bodying materials, pigments, oils and lubricants is essential if the finish is to withstand such treatment without cracking or flaking off. Many supply houses specialize in this class of materials for tannery use. Synthetic materials such as acrylate and vinyl emulsions have been used in increasing percentages. Many of the conventional materials, however, still find a place and, indeed, there has been a return to the aniline type finish in the last few years.

Organics find growing use

Many nitrated and chlorinated organic materials have found industry-wide acceptance in prevention of mold and mildew in processing and in finished leather, complementing the use of fluorides and inorganic compounds.

The pent-up demand for leather products, together with a worldwide shortage of hides and skins, drove raw stock prices to excessively high levels when government controls were relinquished in 1946. Since raw stock represents 60 percent of the leather sales dollar, leather prices were forced to a point where consumer resistance was encountered last year.

Hide and skin prices are receding from their high levels so that the leather industry is in a less vulnerable position. While raw hides and skins are perishable byproducts and must seek their own economic levels, there has been some inflationary tendency.

Tanners move to improve products

Tanners are endeavoring to better their position by improvements of their products, reduction in processing time and reduction in costs through more efficient utilization of materials. Further, they are striving to educate the public in the valuable properties of genuine leather. No tanner has illusions as to the prompt return of easy profits. However, efficient producers are confident that good leathers have a permanent place in our economy, and they are prepared to develop specialties for markets requiring special properties.

While many bulk items, such as lime, sodium sulphide, dyes, chromium and vegetable tanning compounds, are likely to continue on a stable basis, many new or modified materials will be adopted and used increasingly.

Conventional chrome and vegetable tanning preparations are expected to account for a high percentage of tanning materials consumed in the next few years, but it is anticipated that synthetic vegetable replacements, reconstructed tans and improved complexes will assume in-

creasing importance in enabling the tanner to produce better leathers at less expense and shorter time.

The recent commercial development of water soluble phenol resins, and their homologs, as synthetic organic replacements for vegetable tannins is of inestimable value in assisting to make the United States independent of foreign countries as sources of tannin.

Leather finishing has required a wide variety of materials and techniques. Linseed oil varnishes have been employed for patent leather. Pigment and plasticized casein-shellac formulations have had widespread use for many years in finishing other upper leathers. Nitrocellulose, cellulose acetate, polyvinylchloride, latex and polyacrylate dispersions were employed as finish ingredients in 1939, and to an increasing extent in the last several years. The leather industry anticipates the production of very attractive leathers and a wealth of colors, textures and resistance to abrasion and weather hitherto impossible by the adaptation of some of the improved synthetic materials developed recently for war purposes. The tanner will require that such finishes accentuate and embellish the characteristics of his leather without imparting an oil-cloth or cold, clammy feel. Ease of application without the development of toxic or flammable vapors are desirable characteristics.

Raw oils and natural greases were long the only lubricants used on leather. These in turn gave way to emulsions of raw oils and soap. Still later oils were sulphonated and blended with raw oils for which they acted as carriers. These materials are sold to the industry as "fat liquors."

Surface active agents have been employed by tanners since their introduction in this country, and indeed the leather industry was one of the first carload users. These materials are used in conjunction with solvents in degreasing skins. In other cases they are employed in tanning, while in dyeing they assist in the development of uniform color on leather fibres. In still other cases they are employed in emulsifying oils and in formulation of finishes, to suspend pigments. Research on specific applications of anionic, cationic, and non-ionic agents is warranted.

Dinitrophenol, pentachlorophenol, copper naphthanate and many trade-named compounds have been employed by tanners to eliminate mold and mildew development during processing and to reduce any tendency toward mold development under extreme conditions of use.

The Tanners' Council Research Laboratory at the University of Cincinnati has shown that the tanning time for heavy leathers can be reduced from months to days by the use of acetone solution of tannins. These can replace the conventional water extracts or solutions.

In the last ten years there have been tremendous strides in the application of scientific principles to the leather industry. All the larger tanners maintain well equipped technical laboratories. Tanners and their technical staffs are ready and willing to investigate and adopt any techniques which offer possibilities of improving their operation. Due to many sad experi-

Leather finishing uses more organics

New lubricants used

Mold inhibitors employed

ences in the past, they know their complex industry involves many variables, all of which must be controlled if the resulting product is to be satisfactory. The development of any leathers having special characteristics offers a real challenge to chemical organizations. Profitable markets in the leather field await the intelligent chemical manufacturer.

The writers wish to express their apprecia-

tion to Mr. Edward L. Drew, Economist of the Tanners' Council of America for pertinent figures supplied, as well as the members of the Mead Corp., Tannin Extract Division staff at Lynchburg, Va., for assistance in bringing up to date the base figures presented in the article "The Leather Industry," *Chemical Industries*, October, 1944, by Mr. Bell, the senior author.



Synthetics Invade Leather Market

"... This article might have been called, 'Synthetic hides make the cows run for cover.' Nearly 40 percent of our shoe soling is not made of leather."

J. R. HOOVER Director, Plastics Materials Assn.
Vice President, B. F. Goodrich Chemical Co., Cleveland, Ohio

Leather making may be the oldest manufacturing industry known to mankind—older than history itself. We still depend on leather. We like to wear leather, to carry it and to own fine articles made from it.

These desires are stronger than mere utilitarian; they are partly aesthetic, partly mystic, as if each of us subconsciously recalls the ancient debt to those skins which saved his ancestors'.

Last year the American tanning industry converted nearly 105 million raw hides to leathers valued at more than 750 million dollars. That's just for the output of about 400 tanneries, and does not include the value added in making shoes or the other finished products. Some 26 million cattlehides alone were required.

Our chemical industry, a servant of all industries and a creator of many, has strongly cooperated with the tanners in developing better methods, improving leather quality and the various finishes. Leather makers are skillfully combining old and new techniques in a continual effort to reduce process costs.

But, in spite of improvements in technology, the shoe and leather industry has by no means kept pace with the increase of our population, nor with the upsurge in the national economy these past few years.

Leather Production Trails Economic Trends

	Gross National Production ¹	Personal Income ²	Industrial Production ³	Total Cattlehide Leather Production ⁴	Sole Leather Production ⁴
1946	243	276	170	125	105
1948	294	306	190	120	99

¹Estimated. ²1935-1939 average = 100. ³Measured by the number of "equivalent hides."

Shoe consumption in the United States in pairs per capita has dropped from an average of 3.15 in 1936-1940 to 2.98 in 1948.

High prices probably had something to do with this. On the average we are buying fewer shoes and wearing them longer. Maybe we are

walking less; sitting and riding more—saving the soles and wearing out the upholstery.

In view of high labor costs, the leather industry has been stimulated to a greater degree of mechanization; but leather making remains inherently a batch operation.

Tanners are more and more concerned with the difficulties of procuring an adequate supply of hides at prices they can afford to pay. Further technological improvements and increased productivity per man hour will help to peg mounting costs, but the world supply of hides seems sure to become an increasingly serious problem.

It boils down to this: the leather industry hasn't shown progress proportional to national economic trends, and its products are expensive in spite of improvements in technology.

That's where the chemist steps in again. He sees a challenge to make something to take the place of leather—to invade some of its markets with serviceable synthetic materials at lower, more stable prices—to expand the total business. And he has the stuff to do it.

Synthetic elastomers were scarcely known commercially a scant ten years ago. Born under the stress of war, this infant prodigy of the chemical industry today measures its production by hundreds of thousands of tons annually. Its technology, the tailoring of flexible polymer molecules, moves ahead rapidly. A considerable share of the effort is aimed squarely at markets traditionally served by leather.

More people in the United States are walking on shoe soles made of synthetic materials than ever before. Trade estimates are that nearly 40 percent of our shoe soling is not made of leather. As contrasted with prewar natural rubber compositions, most of today's non-leather soles are basically a new combination of American synthetic rubber and a special high styrene-butadiene resin. The resin imparts firmness, exceptional flex life and long-wearing qualities without sacrificing light weight, wide color range or excellent low temperature properties. Soling manufacturers are adopting the generic

Leather costs too much

Heaven for synthetic soles

Leather lags our economy

1.
Upholstery

2.
Luggage

3.
Luggage

4.
Briefcase

5.
Handbag

6.
Holster

7.
Instrument Case

8.
Basketball

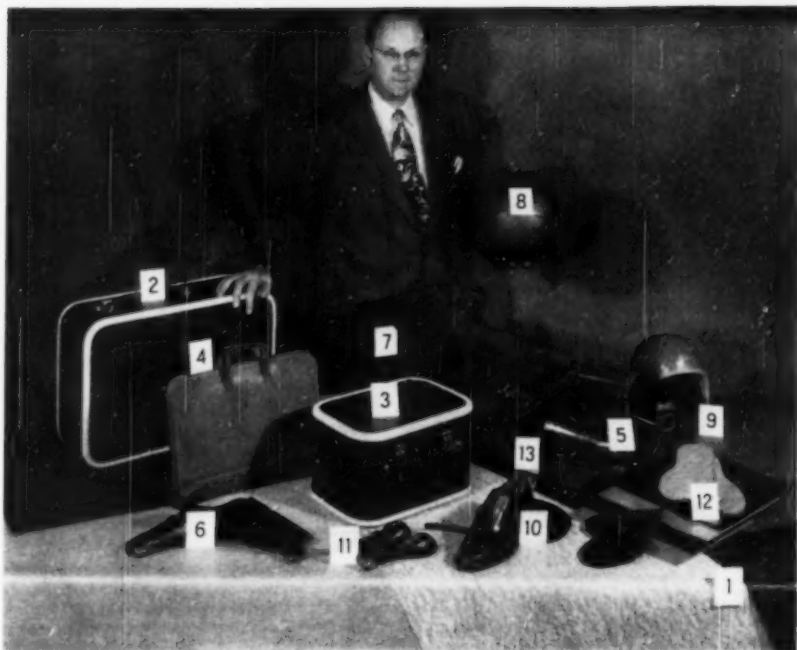
9.
Helmet

10.
Shoe welting

11.
Belts

12.
Shoe soles

13.
"Patent" sheeting



THESE ARE SYNTHETICS. THEY USED TO BE LEATHER. These thirteen are only a few of the items that leather is losing to synthetics. Shoe uppers is a major field where leather holds its own.

name "nuclear" to distinguish this kind from other non-leather soles. Nuclear soles outwear leather by a wide margin.

These synthetic soles are waterproof and mildew resistant, but not slippery. They have the good appearance and light weight of leather, are just as comfortable to wear, and the price tag is a lot lower.

Synthetics cost less
Costs to the shoe manufacturer average about 25 percent less than for good leather; in the replacement market around 40 percent less. Chalk that one up for the chemists!

Shoe manufacturers find that they can use the same methods as for leather and the same machines, without adjustments, to apply nuclear soles. Attachment is made by either stitching or cementing. The soles edge-set satisfactorily and can be buffed to a fine, velvety finish. In use, they remain firm, flat and non-marking.

As for the question of foot health and comfort, thorough tests conducted under the auspices of the Chemical Research Division of the National Association of Chiropractors have shown no difference between nuclear soles and leather.

Synthetics will continue to gain in the shoe soling field. Remember, their technology is yet young. According to Mark A. Edison, president of the National Association of Shoe Chain Stores, speaking last November at the 32nd Annual Meeting of the Tanners' Council, "The public's reaction to non-leather soles has gone beyond mere acceptance. Consumers have begun to ask for them. When that occurs, a material

can no longer be thought of as a substitute, any more than nylon or rayon can be thought of as substitutes for silk."

Rubber heels were an accepted standard in the shoe industry before the war. American rubber successfully takes the place of the natural product for this purpose. Toplifts (women's heels) made from American rubber—high styrene resin compositions are becoming widely used.

For other parts of shoes the flexible vinyl plastics are making headway. Extruded vinyl welting is tough, waterproof, easy to apply and retains its neat appearance in service. Scuff-resistant vinyl toe caps add to the life of boys' shoes. Straps extruded from translucent or colored vinyls have created new styling possibilities in women's footwear.

The trend to synthetic upper materials is less advanced than for soling but development men foresee the eventual solution of technical difficulties in this large field.

About 5 million pounds of vinyl resin went for handbags in 1948. Such a great variety of color, texture and styling can be built into these plastics products, and their cost is so low, that women have been buying more handbags than ever before to have one for each occasion.

Patent leather bags have almost disappeared from the market. The plastic patent is just as attractive and far more durable. It keeps its brightness far longer than the varnished leather

More vinyl welting

More vinyl handbags

because the finish is integral, not superficial.

Plastic patent bags sell in vastly greater volume than would have been possible for patent leather. The vinyl materials created greater value, lower cost; result, an expanded market.

Vinyls are so versatile that they are not only replacing older materials like leather but are creating new markets of their own. A lot of the products where leather and synthetics appear to be competing simply wouldn't be made and sold in such quantity if the new materials hadn't come along.

Synthetics
are
mildew
proof

One of my friends has carried a vinyl briefcase on long trips into tropical countries where leather goods are rapidly ruined by mildew. He reports no effect at all on the vinyl material. It is waterproof and easily kept clean, too. The armed forces used thousands of molded vinyl instrument cases and binocular covers to replace leather for tropical use during the war.

Speaking of luggage and cases, one of the largest luggage manufacturing companies in the world is using vinyl plastics to cover all its pieces. They turn out luggage on a mass-production basis like the automobile companies turn out cars. To do that you must have uniformity in the materials.

Hides
shape
cause
headaches

It isn't just the price of tanned hides that makes good leather products costly. A lot of the cost is in labor to select the tanned hides, lay them out one at a time, then skillfully cut and match pieces of the right shape from the part of the skin best suited for the product. There's a lot of waste involved, because the cowhide, while perfectly shaped to fit the cow, was never designed to fit sofas or suitcases.

Flexible vinyls, on the other hand, may be produced continuously in sheets up to 72 in. wide as thin or as thick as you need. Color, toughness, flexibility and all the other qualities are engineered and controlled to suit the application.

In the form of sheets, either with or without a fabric backing, nearly 50 million pounds of vinyl plastics were used for upholstery in 1948. It covered furniture in homes, restaurants, hotels and clubs—seats and panels in cars, buses, trucks and streetcars.

On the average good vinyl upholstery material costs a furniture or automobile maker less than one-half the price he pays for leather deep buffs and less than one-quarter of his top grain leather cost. Cutting losses run 15-20 percent with leather; under 2 percent for plastic sheets.

Synthetics
create
new
markets

Only a portion, probably a minor portion so far, of the vinyl upholstery has actually displaced leather. Mostly it has supplanted fabrics and another portion represents new business which was made possible by providing new consumer values. There is here, nevertheless, already another challenge to leather's markets.

A vinyl sheeting recently developed is internally reinforced with nylon mesh fabric. The material appears and feels like unsupported sheeting, yet has extremely high tear strength. It costs less than deep buffs.

Electronic heat-sealing techniques have reached the point where this method of fabricating is taking the place of stitching in many vinyl plastic products. The seams are then

continuous, waterproof and tend to distribute strains more uniformly.

Upholstery materials are being styled better, made with better flexibility at low temperatures, better "slip" and feel. Non-extractable plasticizers are imparting longer life.

This in itself is the greatest advantage of flexible synthetics in their bid for markets: the ability to create endless variations in polymers, copolymers, polymer blends and compositions; and their adaptability to a wide range of processing and fabrication methods such as extrusion, molding, casting, calendaring, coating, embossing, printing, stitching, cementing, heat sealing and cutting—so that dimensions, finished properties and costs for each end use are controllable to a high degree. This inherent advantage can be summed up as versatility.

Synthetics
are
versatile

Other general advantages of the synthetic elastomers are: (1) water and chemical resistance, which also means easy washability, (2) mildew resistance, an outstanding advantage over leather, (3) color and decorative possibilities, (4) wearability, which includes toughness and resistance to abrasion, (5) uniformity, because of controlled chemical and mechanical operations; (6) relatively low, stable costs.

The possibility of stabilizing material costs within a relatively narrow and reasonably low range should of itself be a big incentive for shoe and other leather goods manufacturers to encourage the development and use of synthetics.

Better
cost
control

Already sole leather markets have felt in some degree the stabilizing effect of the nuclear soles development. So will other leathers tend toward less drastic price fluctuation as the flexible synthetics become a larger factor of competition. Benefits will accrue to tanners, fabricators and consumers.

It was inevitable that in such a young and fast-growing industry as plastics there would be mistakes made; mistakes in products, application and merchandising—"growing pains!"

During the war and right after it ended, people were given a lot of hallyhoo about the bright new postwar world in which chemistry and electronics would do everything cheaper and better and prettier. So as soon as Mr. and Mrs. Consumer saw the new products in store windows they rushed in to buy. Many of these early postwar products were poorly designed and overpriced. Some of the shoe soles and handbags and upholstery stiffened and cracked. There was considerable disillusionment.

Misuse
backfired

I think we are down to earth again now. More and more the plastics and chemical rubber products are being engineered for a better balance of qualities, better performance, better style, better value.

And all along the line the watchword is "put these new materials only into places where they can give greater value." Most of the flexible synthetic products of 1949 are of excellent quality, well designed, intelligently applied, well styled and low priced. That trend is going to continue. There is still need for improvement, and it will come. The buying public and the manufacturers alike are quality and price conscious. That's all to the good.

The basic problem isn't to duplicate leather or

any other existing commodity. Certainly not to imitate. It's a problem of designing and adapting new materials to fulfill various functions better and more economically. Sometimes that means displacing leather, sometimes wood, paper, metals, glass or textiles. Often it means creating entirely new values and demands that the older

Now the question is, will all this eventually put the leather tanners out of business? I don't think so—but I am confident that in reaching for their own economic niche the flexible syn-

thetics will challenge a larger and larger share of markets traditionally served by leather.

Plants are already built which can turn out double the present total quantities of synthetic material. Ready availability, versatility and fast-stepping technology spell future growth.

The increasing competition between leather and synthetics is sure to stimulate the development of more economical processes and better products by both industries, sure to expand the total market, sure to bring better values.



Leather and National Defense

"... We face the necessity for obtaining relief from a stark fact: This country is almost completely dependent on imports for its tanning materials."

S. J. KENNEDY Research Director; Textile, Clothing and Footwear Section; Office of Quartermaster General

The interest of the National Military Establishment in research and development of new chemical products for the leather industry is two-fold: First, we desire to improve the functional performance of military footwear and equipment made from leather, which in turn can be accomplished only by improving the physical properties of military leather. And second, we face the necessity for obtaining relief from a stark fact: This country is almost completely dependent upon imports for its tanning materials, imports which could not be expected to be available in adequate quantity in time of war. The Leather Research Program of the Research and Development Branch of the Office of the Quartermaster General is directed along both of these lines.

We need domestic tannins

There is no secret to the fact that the domestic supply of vegetable tanning materials is comprised almost wholly of the uncut stand of dead chestnut trees in the Southeastern Appalachian forests. On an optimistic basis, what trees are left might supply a sixth of the industry's normal requirements for another ten years. Beyond that time there is no source in the products of forest and farm which can be counted upon at this time to supply any significant amount of the leather industry's needs of tannin.

Currently the Department of Agriculture is attempting to complete technical research on the growth and extraction of tannin from cinnabar roots. This source is one of the most promising of these alternative sources, since its roots contain as much as 40 percent tan.

Another approach to providing a domestic source of tannin for the leather industry is in the utilization of lignosulphonates and other by-products of the pulp and paper industries.

The necessity for finding a substitute for quebracho is accentuated by the fact that this material is also being used in large quantities as a mud conditioner in oil well drilling.

While research is being continued to find new natural sources of tannin in products of forest and farm, two lines of development in the synthetic chemical industry are proceeding to lessen military dependence upon agricultural tannins.

The first is the development of true synthetic tanning materials. By this is meant replacement materials which actually substitute for natural vegetable tanning materials. One such material, Orotan, made by the Rohm & Haas Co., is now on the market.

Evaluation of Orotan as to its utility in tanning military leather is currently under way.

The second way in which the chemical industry is lessening the demand for natural tanning materials is by the outright replacement of leather by synthetic materials in the components of soles and heel lifts, as well as in mechanical leathers.

The substitution of the composition sole for leather soles on combat footwear by the Army was a major replacement of this type. As a matter of fact, it would have been absolutely impossible to have supplied the Army with sufficient footwear using leather soles, since the composition sole was found to have several times the life of the leather sole.

Most upper leather used in civilian shoes is chrome tanned, but army upper leather, in addition to being chrome tanned, is then retanned with vegetable tanning material. This retanning makes for more comfortable shoes, and leather which dries out softer.

In the other major division of leather manufacture, chrome tannage, there is the same problem of potential shortage arising from dependence upon imports for our chemical chrome ores. Here chrome, as basic chrome sulphate, is used for the primary tannage of all army shoe upper leather, and as the tannage for upper leather for the low quarter oxford, for gloves, and for the bulk of civilian shoe uppers.

We need synthetic tannins

We need chrome substitutes

As a matter of fact, leather can also be tanned with alum, zirconium and iron compounds in place of chrome. None of them give as good a tannage for army shoe leather as chrome.

There is a further type of synthetic tannage, derived from the work of the Germans in their development of synthetic tannages. This is the hummergan or sulphonyl chloride tannage, otherwise referred to as an oil tan.

The hummergan type of development brings us to another development of far-reaching importance in the production of leather, which may have even more immediate application to military leather. This is the production of synthetic stuffing and fat liquoring materials for leather.

Research on stuffing leather

Research on the production of synthetic stuffing and fat-liquoring materials for leather is currently under Research and Development contracts with Ohio State University and the University of Cincinnati, in the Tanners' Council Laboratory. Pilot plant scale production of leather, using several very promising materials, is currently under way.

Developments in leather technology, and research and production in the chemical industry are proceeding on a rather broad front. This decade may later be found to be one of the most revolutionary for this industry, or at least one in which major new lines of technological progress have been opened up.

To return to the first of the two aspects of leather research mentioned at the opening of this discussion, a word or two should be said regarding the improvement of the functional performance of leather military footwear and equipment.

This falls into four general areas: Improvement of the water resistance of leather, improvement of its wear resistance, improvement of its stability as a chemical product, and finally the improvement of the comfort factor, or at least its retention at the level of good leather quality while simultaneously improving leather in other respects.

Foot comfort is important

The quality of foot comfort here may be interpreted in many ways, some of them related to the foot and others related to other parts of the body. In part this is a problem of the flexibility or rigidity of the materials in the shoe, in part it is a problem of shoe design and construction, and in part is a matter of the condition and structure of the foot itself.

A third aspect, and the most important from the standpoint of the leather, is the relation of the shoe to the foot as a body structure, from which moisture is given off both as insensible perspiration, normal perspiration from the foot area, and perspiration resulting from emotional disturbance. Just how much moisture one should expect to be given off as perspiration has not been adequately determined.

Want one-way permeable leather

This problem of perspiration is one of the most critical problems of military research in the field of environmental physiology. The term "one-way permeable" has been used to describe the kind of material which is sought in order to retain a modicum of comfort. Leather in its ordinary tannage is inadequate as a material for military items if we consider

that this required property is of fundamental importance. There is no way known at present for treating leather so as to retain its vapor permeability, while at the same time to make it resistant to passage of water from the exterior under dynamic conditions.

Accordingly, our office several years ago initiated a study of the impregnation of leather with resins of small particle size which could then be polymerized *in situ* in the leather to the desired extent. By selection of the resins or similar materials it was considered feasible to lubricate the leather, at the same time making it impossible for the resins to be removed by any subsequent mechanical action.

Work on resins for leather

The opportunities for modifying physical properties of leather which are suggested by this approach will be obvious. It should be possible to modify not only the water resistant characteristics, but also its wear resistance as well as its other mechanical properties.

In addition to the application of such resins and other synthetic materials to leather for gloves and uppers of shoes, the National Bureau of Standards under a joint project with our office has been exploring the impregnation of sole leather with resins, such as acrylates and rubbers. The implication of this, of course, would be that a treated leather sole would be vastly more resistant to wear, while at the same time retaining a great many or most of denied properties of the leather itself, depending upon the extent to which the impregnation is carried.

Leather has one property which involves some risk to the military when we consider world wide operations. Under conditions of high temperature and humidity in storage, probably even around such temperatures as 120 deg. F. with relatively high humidity, it will tend to hydrolyze. Since it is not always possible to store any military item under ideal conditions, study is needed to insure that what we buy will be serviceable when we need to use it. For one thing, we are quite sure that there are levels of pH in the finished product which should be avoided, even though all leather is finished on the acid side. The introduction of any new compounds to provide a functional finish or quality must be related to this basic important characteristic of stability of the finished product.

Tropics cause trouble

In the final analysis, the Quartermaster Corps has no other reason for being, so far as this field is concerned, than to provide personal protection to the soldier. That is our first and foremost responsibility. Research in weapons is directed primarily toward increasing their effectiveness in destroying the enemy. We seek to preserve the health of the soldier and to increase his efficiency through the improvement of his food, clothing, equipment and shelter in the field. It is our job to give him that extra ounce of stamina and endurance which will spell superiority in the struggle against both his environment and the enemy.

Reprints of this report are available at 35c. per copy. Address the Editorial Department, Chemical Engineering, 330 West 42nd St., New York 18, N. Y.



A Comprehensive answer to many requests for more information, please!

REPORT: on the new Votator Semi-Continuous Deodorizer

To deodorize edible oils, a current of stripping steam is used to carry odoriferous materials away from the oil. For every pound of stripping steam, 3 to 4 pounds of steam must be used on boosters and ejectors to maintain vacuum on the oil. The steam must be condensed, hence much condenser cooling water is also consumed.

The deodorizing operation is the "steam hog" of the edible oil plant:

In many plants, up to one-half the total steam generated is used in deodorizing. In view of high fuel costs and fuel shortages this can be serious and the following fact is of the first importance:

SAVES STEAM AND WATER

The Votator® Semi-Continuous Deodorizer saves 70 to 90 per cent of the stripping and vacuum steam consumed by batch deodorizers, with proportionate savings of condenser cooling water.

Batch operation ordinarily requires 15 to 45 pounds of stripping steam, and 55 to 165 pounds of vacuum steam, with heavy intermittent peak demands. Such demands never occur with the Votator Semi-Continuous Deodorizer, and its stripping steam consumption is only 4.5 pounds per 100 pounds of oil, while its vacuum steam consumption is only about 16.5 pounds, depending on steam pressure and cooling water temperature.

This is not an idle claim. We back it up with guarantees.

Votator Semi-Continuous Deodorizer steam and water requirements are low because the steam is made to work efficiently. Once impurities are distilled out of the oil they stay out. There is no condensation and reflux back into the oil.

Installation of the Votator Semi-Continuous Deodorizer will (a) reduce fuel bills, (b) take the burden off overloaded

steam plants, (c) permit expansion of deodorizing facilities where steam supply is short.

YIELDS HIGHEST QUALITY PRODUCTS

The unique design and construction of the Votator Semi-Continuous Deodorizer make it impossible for air to leak into the oil while it is hot.

The oil is not subject to prolonged heating. It is at top temperature only 60 minutes.

The hot oil touches no metal but commercially pure nickel, proved by test to be one of the few metals causing no injury to the stability of the oil. (Carbon steel and many other metals and alloys are quite injurious at high temperatures.)

All of the oil is under high vacuum (5-6mm.) throughout the entire deodorization cycle.

FLEXIBLE AND VERSATILE

No time is lost, no product is lost in starting and stopping the unit, nor in changing from one stock to another.

One stock can follow another through the apparatus without the slightest intermixing. Each tray drains free of oil each time it is discharged.

Shortening stocks, margarine stocks, salad oils, and cooking oils can all be processed in the same apparatus.

The Votator Semi-Continuous Deodorizer is outstandingly effective for "steam refining" of certain high-acid fats and oils. Animal fats processed through it yield high grade edible products without alkali refining. Post-refining of hydrogenated vegetable oils is never necessary in plants using Votator deodorizers.

AUTOMATIC AND RUGGED

A central control panel assembly of the most modern instruments takes over

the watching of times, temperatures and pressures; the starting and stopping of pumps; the opening, closing or throttling of valves.

Once started, the Votator Semi-Continuous Deodorizer literally operates itself.

Complete safety features are incorporated to avoid conditions hazardous to product quality; to stop the apparatus and sound a warning in case of utilities failure or other emergency.

Many months of trouble-free operation have demonstrated that the Votator Semi-Continuous Deodorizer will give dependable operation day in and day out, without "babbling."

INSTALLED COMPLETE

The purchaser of the Votator Semi-Continuous Deodorizer gets a complete packaged unit, engineered to his specific needs.

This includes the deodorizer proper plus all accessory equipment, all required engineering and engineering drawings. After the deodorizer is installed, it is ready to operate. The purchaser need only bring oil and utility lines to it.

There are no extras to worry about. No divided responsibility for successful operation.

REASONABLE FIRST COST

The purchaser of the Votator Semi-Continuous Deodorizer does not pay a premium for its many advantages.

A 5000 pounds per hour unit, for example, can be installed at a price comparable to the cost of conventional carbon steel batch apparatus capable of deodorizing 120,000 pounds of oil per 24-hour day.

This is one among various Votator accomplishments in the field of oil and chemical technology. Votator heat transfer apparatus, process design, and plant construction have been of practical benefit to many industries on many other problems, such as cooking, cooling, crystallizing, hydrogenating, aerating, emulsifying. If you process a viscous or liquid material, let a Votator engineer check the effectiveness of present methods. Our preliminary engineering service on plant modernization projects is available on an exceptionally attractive cost-plus basis.

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Corn Products

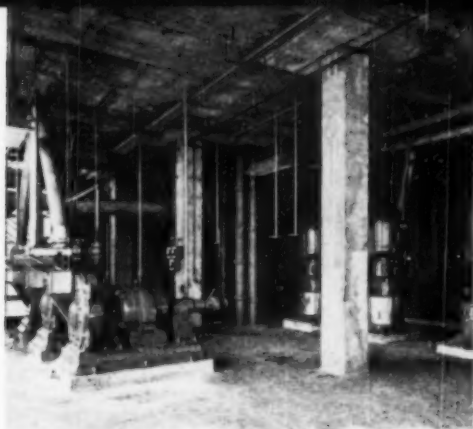
Article on page 120

The wet milling plant of Corn Products Refining Co. at Corpus Christi, Tex., is the first designed specifically to process sorghum grains. Dextrose, stock feed, starch and edible oils will be made.

Grain is first cleaned, scoured and conveyed to storage, steep house or dryer, depending on moisture content. Water from the steeping process is pumped to the feed house, after it has been concentrated, the resulting heavy sirup is combined with protein stock feed. Steeped grain is dewatered, ground and passed to degerminating mills. These break up the grain to permit recovery of germ. Ground material moves to germ separators. The germ is then screened and the starch removed by water. Germ is dried in a rotary dryer and distributed to expellers. Oil is filtered in a plate and frame press and shipped to the company's plant in Illinois for refining. The cake from the expellers is moved to a cake mill where it is ground prior to being combined with other stock feed components.

It is necessary to return to the milling operation where fine and coarse fibers are separated, and follow from there the course taken by the fine fibers, starch and gluten. The mixture is discharged and passed over dewatering screens. The filtrate, containing starch and gluten, is passed over a drum filter. Filtrate from the drum is returned as steep water to grain steep tanks. Filter cake is slurried with water.

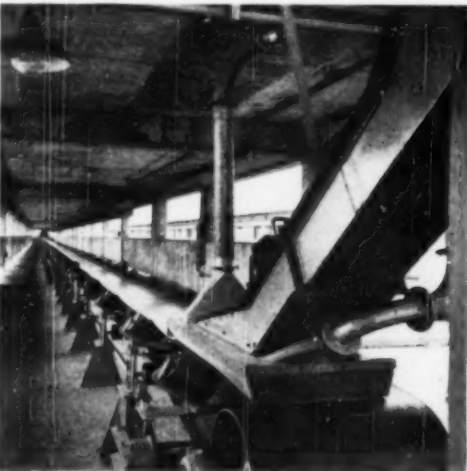
The fine fiber retained on the screens is freed of starch and pumped to the feed house where it is combined with gluten and processed to protein stock feed. The gluten-starch mixture obtained as a cake on the string discharge drum filter is separated into the two components. This occurs in centrifuges. Relatively light gluten moves upward and is discharged at the top of the bowl. Meanwhile, starch is forced to the periphery and is discharged through nozzles in the bowl to a vent box. It is withdrawn from the bottom of the box. The gluten concentrated in centrifuges is pumped to the feed house where it is dewatered and dried. It is protein feed stock.



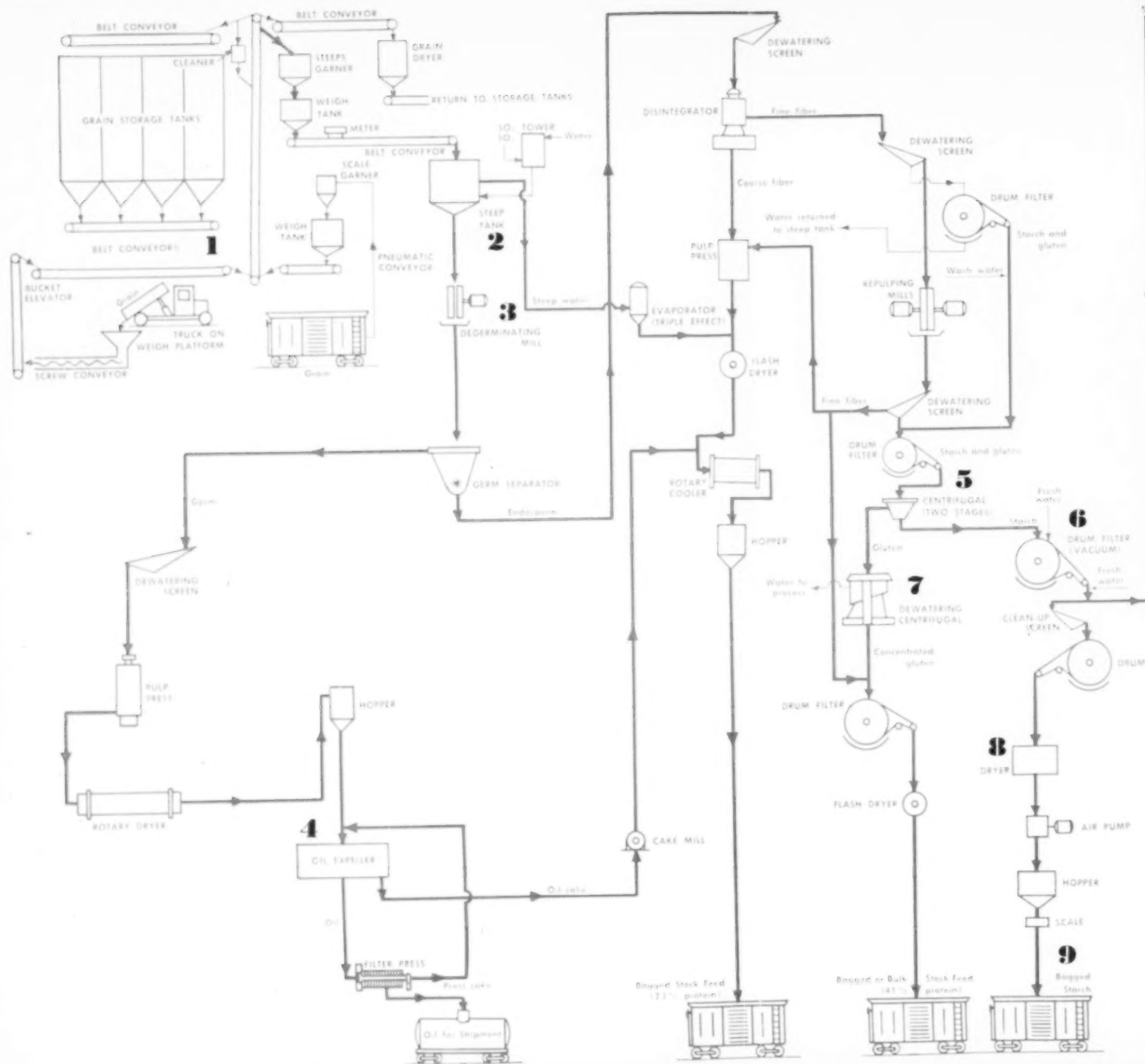
1 BELT CONVEYOR carries grain to storage tanks having a total capacity of 2 million bushels.



2 TANKS with water containing SO_2 in which grain is steeped to condition it for separation into components.

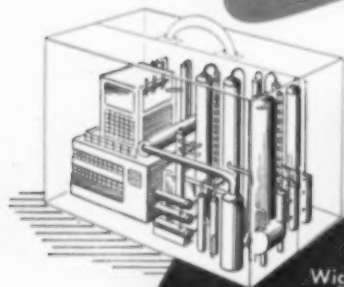


3 DEGERMINATING MILLS break up steeped grain. Disintegrators prepare it for recovery of starch.



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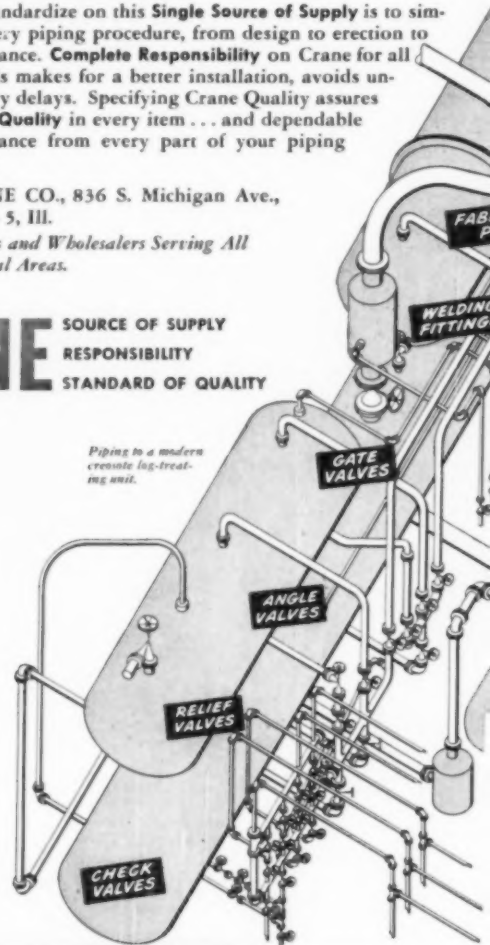
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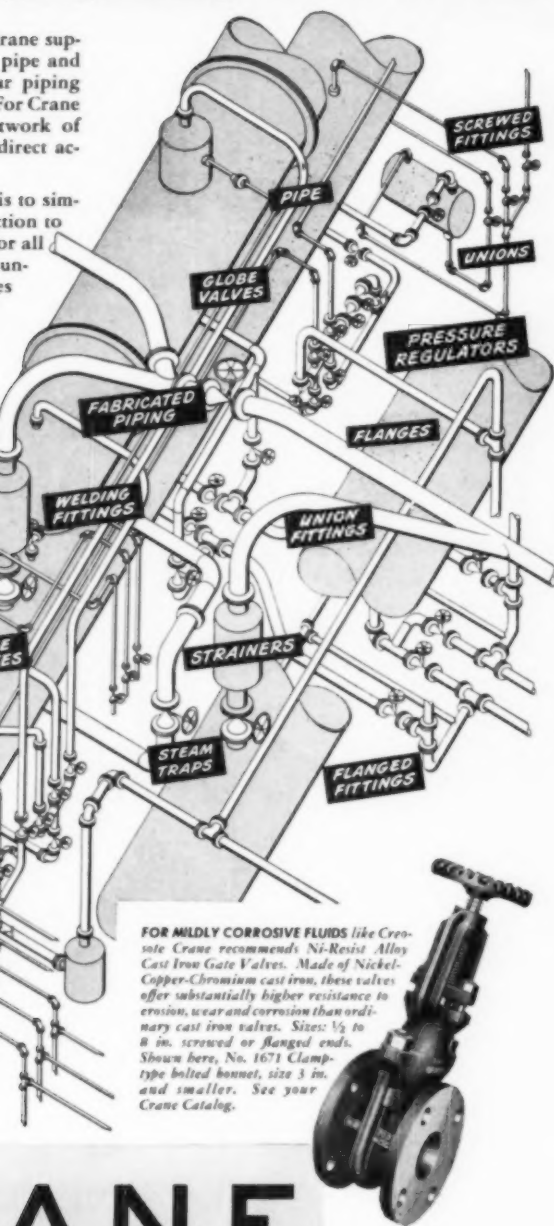
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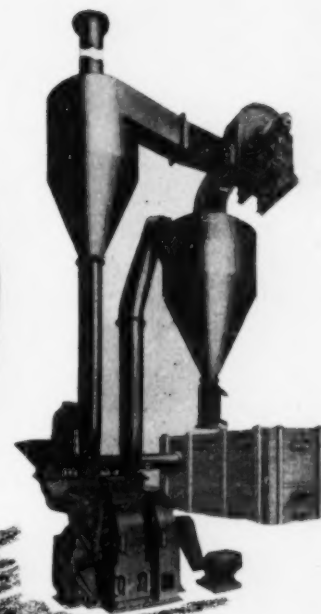
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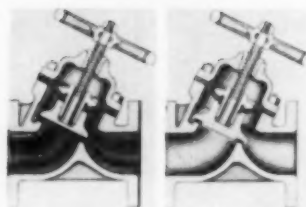
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Process Equipment News

THEODORE R. OLIVE, Associate Editor



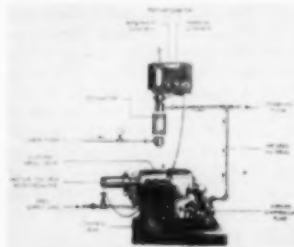
**NEW SEALING METHOD:
Improved Diaphragm Valve**

Crane Co., 836 South Michigan Ave., Chicago 5, Ill., has introduced a new line of diaphragm valves in which a diaphragm is used to seal the bonnet only. A separate seating member gives positive control of the flow, independently of the diaphragm, which is said to increase diaphragm life greatly. It is claimed also that this feature makes the valve easier to operate than the diaphragm-closure type. The valve is of the Y-pattern type for greater flow capacity, made in two variations, one with a plain iron body, and the other lined and coated with neoprene. Both types have bolted bonnets. The plain iron valve is made in sizes from $\frac{1}{4}$ to 2 in. with screwed ends, and from $\frac{1}{4}$ to 4 in. with flanged ends. The neoprene lined type is made with flanged ends only in sizes from $\frac{1}{4}$ to 4 in. In the plain iron type, a neoprene insert in the disk is the actual sealing element. The plain iron valves are designed for services up to 150 psi. pressure and 180 deg. F. temperature. Temperature limits of the neoprene-coated valve depend on service conditions and fluids carried.

NO FORKS: Clamp Lift Truck

The Baker Industrial Truck Div. of the Baker-Raulang Co., 2168 West 25th St., Cleveland 13, Ohio, has announced a new clamp truck which utilizes hydraulically-operated clamp arms to grip the load for lifting and transporting. There is, therefore, no need to place the load on skids or pallets. The clamp, of all-welded steel construction with dual double-acting hydraulic cylinders, is mounted on the truck lift carriage. The truck's hydraulic system supplies the necessary oil under pressure to the clamp cylinders.

The pressure required is under full control of the operator, permitting the handling of loads varying from fragile items to heavy industrial equipment. A variety of kinds of clamp arm are available, depending on the character of load to be handled.



**FOR SEVERE SERVICE:
Proportional Feeder**

T. Shriver & Co., 810 Hamilton St., Harrison, N. J., has developed a new proportional feeder based on this company's diaphragm pump, which is suitable for handling corrosive, abrasive, viscous or other difficult liquids and suspensions. The pump is driven by a variable-speed drive, activated through a rotameter in what is essen-

tially a wheatstone bridge. This device increases or decreases the volume of slurry fed to the pump in accordance with variations in the rate of the main flow. The control circuit employs electronic rectification and amplification, operating a relay which in turn supplies current to the adjusting motor of the variable-speed drive. The control system can be adjusted as to sensitivity and it is provided with an anti-hunting device to minimize overshooting.



**MAINTENANCE SIMPLIFIED:
Wooden Acid Tank**

Weber Wood Works, 6613 South Emil Ave., Bell Gardens, Calif., has introduced an improved type of wooden acid tank, said to offer several advantages. In this construction the steel stay-rods are entirely on the exterior, instead of running through the planking. This permits thinner wood planking to be used, and yet enables the entire thickness of the wood to separate the steel from the tank content. Since the rods are easily inspectable and accessible, maintenance is facilitated and replacement, if necessary, becomes easy owing to the cantilever clamping construction of the tank walls.

FASTER, TIGHTER: Improved Valve Bag

Arkell and Smiths, Canajoharie, N. Y., has announced a new valve bag known as the Shur-Close which is claimed not only to permit faster filling, but also to prevent sifting. The valve is said to close tightly, thus eliminating waste from seeping. The company is prepared to make immediate delivery on the new bag which is suit-

(Continued)

Marshall and Stevens Indexes of Comparative Equipment Costs (1926 = 100)

Compiled quarterly for March, June, September and December of each year by Marshall and Stevens, evaluation engineers, Chicago and Los Angeles. Indexes are prepared for 47 different industries, from which the eight process and four related industries listed here are selected. Published each month with the latest available revision. For a description of the method of obtaining the index numbers see R. W. Stevens, *Chemical Engineering*, Nov. 1947, pp. 124-6. For a listing of annual averages since 1913 see *Chemical Engineering*, Feb. 1949, p. 129.

Industry	Mar. 1948	Dec. 1948	Mar. 1949
Average of all.....	138.4	166.0	165.1
Process Industries			
Cement mfg.....	152.0	159.8	159.4
Chemical.....	160.0	167.8	167.5
Clay products.....	147.0	154.8	154.5
Glass mfg.....	150.1	157.9	157.6
Paint mfg.....	153.3	161.1	160.8
Paper mfg.....	153.6	161.4	161.1
Petroleum ind.....	156.4	164.2	163.9
Rubber ind.....	158.8	166.6	166.3
Process ind. avg.....	157.4	165.2	164.9
Related Industries			
Elec. power equip.....	161.6	169.4	169.1
Mining milling.....	160.7	168.5	168.2
Refrigerating.....	170.6	181.3	181.2
Steam power.....	148.7	156.5	156.2

New Equipment, cont.

able for all standard filling machines. The valve is said to be adaptable to multi-wall bags of any number of plies. Tests are claimed to have shown filling speeds approximately one bag per minute greater than that of conventional sleeve bags.



SAVES PALLET:
Handling System

The Automatic Transportation Co., 149 West 87th St., Chicago, Ill., has developed a new pallet, and a push-pull attachment for its electric fork trucks, which make possible mechanized shipment of merchandise without the use of pallets in transit. The attachment includes multiple forks, a device for pulling loads on board, and a device for pushing them off the forks into position. The pallet is of corrugated metal, having two sets of openings which permit the fork to lift the load and pallet together, or to remove the load from the pallet. Before the load is palletized, it is placed on a sheet of heavy paper and then is drawn onto the forks of the truck. The forks are lifted slightly and the load placed on the pallet. It can then be carried, stacked and unstacked in the usual manner. When ready for shipment, however, it is taken to the shipping dock where the forks are inserted in the second set of openings in the pallet, and the load, together with the paper sheet, is lifted clear. The truck carries the load into the box car and then pushes it into position.



TIME SAVING:
Infrared Analyzer

The Perkin-Elmer Corp., Glenbrook, Conn., has developed a new infrared analyzer for the continuous,

automatic analysis of as many as six different components in a flowing stream. The stream may be either liquid or gas phase. The instrument comprises four units including the infrared monochromator (similar to that used in this company's infrared spectrometer); an automatically-driven 12-point turret comprising one reference point and one absorption point for each of the six components; a 12-point strip recorder automatically synchronized with the turret; and an amplifying circuit. The cycling time for a six-component analysis is about 6 min. Known as Model 12-D, this analyzer is said to be particularly useful in saving time in pilot plant operations where optimum process conditions are to be determined. Operating variables such as temperature, contact time, flow rate, etc., may be varied continuously and evaluated immediately from the automatic analytical record. In a continuous multistage process, sampling may be performed at intermediate stages for independent evaluation.



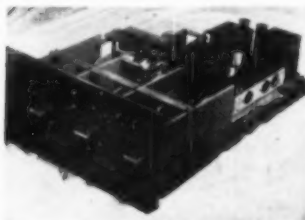
AVERTS SURGES:
Discharge Check Valve

The J. A. Zurn Mfg. Co., Erie, Pa., has developed a new discharge check valve designed to protect against contamination of liquids, fouling of pumps and equipment. It is said to be useful wherever back surge is a problem in discharge lines carrying steam, sludge, waste water and other waste liquids in gravity flow installations. To minimize fouling the valve has a swing check flap suspended from a full-floating pin fulcrum to insure full surface contact between the flap face and its seat. The flap is located to give protection against the possibility of sediment blocking the valve. Such valves may be operated with or without a manual control or with an extension shaft or flexible cable from an access box. 180-deg., 105-deg., and 90-deg. bodies of cast bronze, steel, semi-steel, cast iron and alloy metals are available.



SAFE, PORTABLE:
Drum Rotator

Morse Manufacturing Co., 122 Dickerson St., Syracuse 2, N. Y., has introduced a portable, motorized drum cradle truck, intended both for moving the drum from place to place, and for rotating it for mixing and agitating. The same device is capable of rotating containers from 1-gal. round cans, up to 55-gal. drums. It is provided with a 1-hp. motor which powers the rotating mechanism. Drums weighing up to 500 lb. can easily be loaded or unloaded by one man with the aid of a tipping lever which is part of the complete equipment. The truck is provided with swivel casters at the front end which are easily retracted to prevent slipping of the truck in loading. The drum may be emptied if desired while on the cradle.



ELIMINATES CALCULATION:
Color Computer

General Aniline and Film Corp., 230 Park Ave., New York 17, N. Y., has developed a new color-computing device for use with the G-E Hardy spectrophotometer, which integrates continuously over all portions of the visible spectrum and can tell immediately whether a given color will match another color, or if not, what the difference between them may be. Known as the General Aniline-Libra scope tristimulus integrator, the device is said to figure out the answer to a series of computations involving integral calculus before a man attempts (Continued)

NOW...

**Larger Pfaudler
acid-resisting
glass-lined
chemical
storage
tanks**

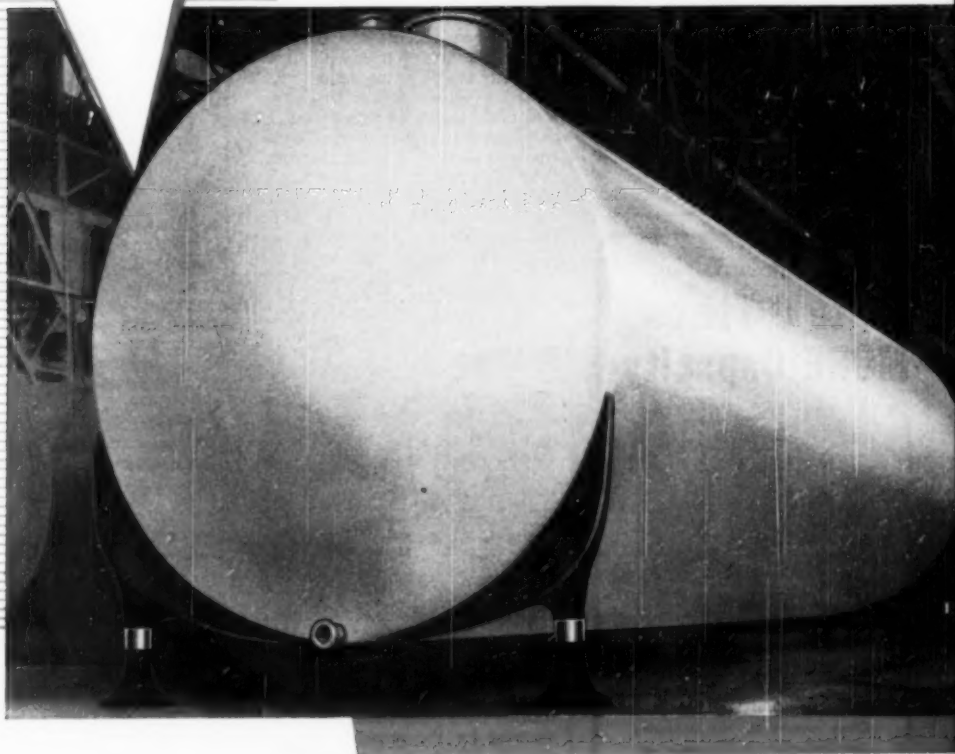
Highly acid-resisting Pfaudler glass-lined steel chemical storage tanks are now available in substantially larger unit sizes than ever before, due to improved methods of manufacture. The result is a marked saving in cost per gallon of storage facilities.

Storage tanks for *all acids, inorganic or organic* (excepting HF), *above 125 deg. F.* are now available in one-piece construction, electrically tested, up to 5500 gallons.

Storage tanks for *all inorganic or organic acids* (except HF) *at 125 deg. F. or below* are available up to 13,000 gallons, electrically tested.

As in the past, the exact voltage at which large storage tanks are electrically tested will be adjusted to the severity of the acid conditions.

Storage tanks for neutral and most anhydrous solutions, such as glacial acetic acid, alcohol, formaldehyde and numerous other solvents, are available up to 35,000 gallons. These are not electrically tested. Your inquiries will receive prompt attention. Let us quote on your requirements.



Pfaudler

THE PFAUDLER CO., Rochester 3, N. Y. Branch Offices: 330 West 42nd St., New York 18, N. Y.; 111 W. Washington St., Chicago 2, Ill.; 1328 Howard St., San Francisco 3, Calif.; 818 Olive St., St. Louis 1, Mo.; 13231 W. McNichols Rd., Detroit 21, Mich.; 1318 1st Nat'l Bank Bldg., Cincinnati 2, O.; 1041 Commercial Trust Bldg., Philadelphia 2, Pa.; 751 Little Bldg., Boston 16, Mass.; 334 Chattanooga Bank Bldg., Chattanooga, Tenn.; P. O. Box 4066, Dallas, Texas; Enamelled Metal Products Corp., Ltd., Artillery House, Artillery h.w. London, S. W. 1, England.

THE PFAUDLER CO., ROCHESTER 3, NEW YORK
ENGINEERS AND FABRICATORS OF CORROSION RESISTANT PROCESS EQUIPMENT
Glass-Lined Steel... Stainless Steels... Nickel... Inconel... Monel Metal



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Why risk labels that soak, fall or burn off. Write on glass containers with Blaisdell "Laboratory" Markers. Marks are vivid, waterproof, permanent... won't run at temperatures up to 300°C... can be removed with a damp cloth.

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OR MAIL COUPON FOR FREE SAMPLE

Blaisdell PENCIL COMPANY

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Send no money now.

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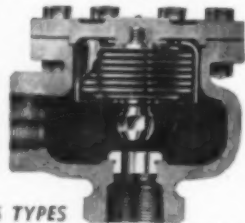
BLAISDELL

STREET

CITY, STATE, ZIP

NICHOLSON STEAM TRAPS show

**2 to 6 Times
MORE Capacity**



5 TYPES

for Every Application

Recent comparative tests by large trap users again showed the enormous capacity of Nicholson units. Other reasons for the increasing standardization on Nicholson: operate on lowest temperature differential; record low for steam waste. 5 types: size 1/4" to 2"; press. to 225 lbs. BULLETIN 1047.

W. H. NICHOLSON & CO.
206 Oregon St., Wilkes-Barre, Pa.

NEW EQUIPMENT, cont . . .

ing the same job by hand could sharpen his pencil. It was designed by H. R. Davidson of General Aniline, while L. W. Imm of Librascope, Inc., Burbank, Calif., engineered it. Used with the Hardy spectrophotometer, it is said to be able to distinguish more than 100,000,000 different colors. The instrument completes all necessary calculations within 24 minutes from the start of operation of the spectrophotometer. Calculation accuracy is said to be within 0.05 percent.

**SMALLER, LOWER COST:
Improved Steam Trap**

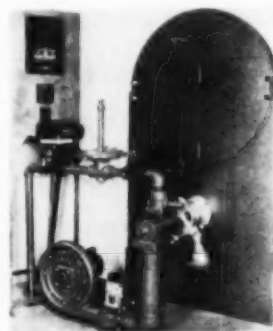
The V. D. Anderson Co., 1935 West 96th St., Cleveland 2, Ohio, has developed a new smaller steam trap, designated as Model 118, and has improved three other traps of its line. The new trap is smaller and lower in first cost, and is designed for light condensate load jobs. Suitable for pressures up to 150 psi., it has a capacity of 700 lb. per hour of condensate (continuous flow) at 20 psi. It is made in the 1/2-in. pipe size. Its construction is of the inverted bucket type with castings of nickel semi-steel, the bucket and guide tube of copper and bronze, and all working parts of heat-treated stainless steel. The simplified design saves both installation time and fittings. Mechanical improvements in other traps of the company's line have increased their capacity, No. 119 going to 300 lb., No. 190 to 980 lb., and No. 120 to 1,650 lb. per hr., all at 20 lb. pressure.



**HIGH-SPEED:
Powder Filling Machine**

Simmons Machine Tool Corp., Albany, N. Y., has announced a new machine for the precision filling of powders into ampoules and small bottles which is said to increase the speed of such operations as much as ten times. The machine measures any quantity from 0.1 cc. to over 7 cc., then automatically dispenses this amount into containers at strokes from 11 to 22 per min. In use the required volume in cc. for the required weight

in grams is first determined, and then, by a micrometer screw adjustment, the exact volume per stroke is obtained. Delivery volume is varied by using plungers of different diameters, and shorter or longer stroke lengths.



**EASILY INSTALLED:
Gas Boiler Burner**

The Bryant Industrial Div., 1020 London Road, Cleveland 10, Ohio, is now offering complete automatic gas burner assemblies for gas-firing boilers from 10 to 180 hp. Only gas piping and electric wiring are needed to complete the installation for the new series BB boiler burners which are shipped as complete packages, including protective equipment and pressure controls. The principal element of the burner is an assembly including a constant pressure blower, single or double burner nozzles, each with compact proportional mixer, zero regulator, motorized air valve, electric ignition pilot and manual reset safety gas valve. Either steam pressure controls, or remote thermostatic control, or both, are furnished. These burners operate automatically over three steps of heat input.



**VERSATILE CARRIER:
Truck-Mounted Tank**

Market Forge Co., Everett 49, Mass., has mounted a 275-gal. aluminum tank in a cradle on one of its

(Continued)

Victor* Chemicals

for better everyday living... on a picnic!



Additional information and experimental samples of Victamide and other Victor chemicals listed here are available upon request. Check those which interest you and mail the coupon today.

Mail the complete coupon today

NEWS...



from Victor's Research Laboratories

Victamide is a complex ammonium amido-polyphosphate which is efficient in flame-proofing, peptizing, and chelating applications. It is a white, water-soluble, finely divided non-crystalline powder.



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Please Check Below

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|---------------------------------------|--|--------------------------|
| <input checked="" type="checkbox"/> 1 | Phosphoric acid... rust preventive and bond for paint. | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> 2 | Formic acid and potassium phosphate... electrolyte in plating baths. | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> 3 | Protan (r) sodium formate, formic acid and "Nalox" sodium oxalate... leather tanning. | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> 4 | Sodium acid pyrophosphate... leavening acid in doughnuts. | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> 5 | Stabilizers 53, 85, 21, and 6162... light stabilizers for vinyl films. | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> 6 | Oxalic acid... straw bleach. | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> 7 | Sodium acid pyrophosphate and mono-calcium phosphate... acid leavening ingredients for prepared flour mixes. | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> 8 | Diammonium phosphate... metachrome dyeing of woolen fabrics. | <input type="checkbox"/> |

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V4

Is yours a problem of BULK MATERIALS HANDLING?



FOR conveying in process from bins, silos, ship holds or in and out of railway cars... whatever the job, as long as it's handling bulk materials, you can benefit from Sprout-Waldron experience and ingenuity.

Whether your materials be light or heavy, dense or bulky, fragile or abrasive, coarse or fine—whether your runs are short or long, horizontal or vertical, consult Sprout-Waldron.

Our facilities embrace a wide range of types and sizes in bucket elevators, belt conveyors, and screw conveyors. There's PNEU-VAC, too—a modern and truly remarkable means of conveying many materials via air.

For prompt consideration of your requirements, write
SPROUT, WALDRON & CO.,
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SPROUT & WALDRON
Manufacturing Engineers

MUNCY PENNSYLVANIA

NEW EQUIPMENT, CONT.

standard load-carrier trucks to produce a novel liquid transporter for intra-plant use. For liquids that cannot be handled in aluminum, a steel tank is available. The truck is 30 in. wide by 63½ in. long and is equipped with two 12 × 24 in. wheels and two 6 × 2 in. swivel casters, cushioned in rubber. These tanks are being used for transporting chemicals, for handling lubricating oil and refilling lubricating equipment, and to supply booster pumps with water in case of fire.

INFREQUENT REFILLING: Automatic Recorder Pen

The Chartomatic Co., 2068 East 37th St., Los Angeles 11, Calif., has introduced an automatic fountain pen for use with all circular chart recording instruments, to be used as a replacement for existing equipment. It is claimed that the new pen will write up to 6 months without refilling or requiring service of any kind. It is said to eliminate the possibility of over-feeding and to assure a fine clean line without unrecorded intervals. The ink is in a closed system, sealed from the atmosphere, and it is claimed that the pen cannot clog or accumulate dirt. The manufacturer, a new concern, claims already to have installed over 4,000 of these pens in oil refineries, gas and chemical plants.



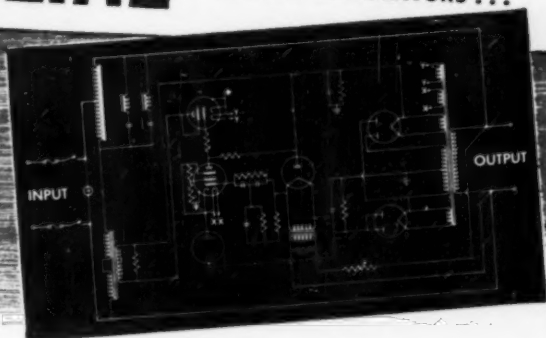
AUTOMATIC OPERATION: Board Machine Cut-Off

The Noble and Wood Machine Co., Hoosick Falls, N. Y., has announced the Raywood Automatic cut-off roll for wet board machines, which is said to be the result of many years of trial and experiment with different kinds of knife mechanisms for make rolls. The new make roll incorporates an automatic cut-off knife which is electrically controlled and pneumatically operated. The knife is projected instantaneously through a slot by pneumatic cylinders which are electrically controlled through relays and an adjustable electric counter. The counter can be set at any predetermined number of revolutions to produce identical sheets of uniform thickness within the limits of vat control. Air pressure released through special jets along the face of the roll, timed to the stroke of the knife, aids

(Continued)

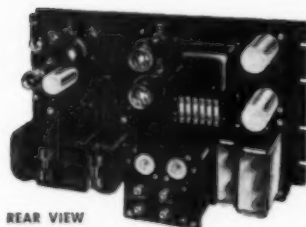
IN STABILINE INSTANTANEOUS ELECTRONIC VOLTAGE REGULATORS...

**IT'S THE
ATTENTION
TO DETAIL
THAT COUNTS**



Attention to detail, from initial development to final inspection, is the "plus value" built into every STABILINE Type IE (Instantaneous Electronic) Automatic Voltage Regulator. It's your guarantee of superior performance and rugged construction. Compare these STABILINES with other voltage regulators. Your inspection will prove to you that every component of the STABILINE has been carefully selected and competently processed — from the iron core components to the black wrinkle-finished cabinet. A rigid performance test will prove that only the latest developments in circuit design — plus up-to-the-minute electronic theory and practice — have been incorporated. After a comparison we think you'll agree . . . attention to detail counts.

STABILINE VOLTAGE REGULATOR TYPE IE



REAR VIEW

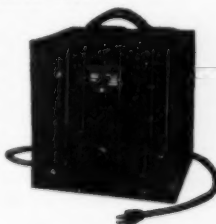
TYPE IE51005

Type	Input Voltage Range	Output Voltage Range	RATINGS				Rated Output KVA
			Frequency in Cycles	Load Range in Amperes	Load Power Factor Range		
IE51002	95-135	110-120	60 ± 10%	0.2-1	+ .5 to -.9		.25
IE51005	95-135	110-120	60 ± 10%	0.4-3	+ .5 to -.9		.5
IE5101	95-135	110-120	60 ± 10%	0.8-5	+ .5 to -.9		1.0
IE5105	95-135	110-120	60 ± 10%	0.4-3.5	+ .5 to -.9		5.0
IE5202	195-255	220-240	60 ± 10%	0.1-1.0	+ .5 to -.9		2.5
IEL51005	95-135	110-120	50 ± 10%	0.4-3	+ .5 to -.9		.5
IEL52005	195-255	220-240	50 ± 10%	0.2-1	+ .5 to -.9		.5
IEL5101	95-135	110-120	50 ± 10%	0.8-5	+ .5 to -.9		1.0
IEL5201	195-255	220-240	50 ± 10%	0.4-3	+ .5 to -.9		1.0

THE NEW 250VA STABILINE TYPE IE

Compact, well-organized construction — plus skillful manufacturing procedure — gives long, maintenance-free service. Superior workmanship means superior performance.

The new STABILINE Type IE-51002 is *portable*! It's easy to carry around the shop or laboratory. It possesses all the superior inherent characteristics found in all STABILINE IE's — self-contained in a portable 11½" x 11½" x 10¼" case.



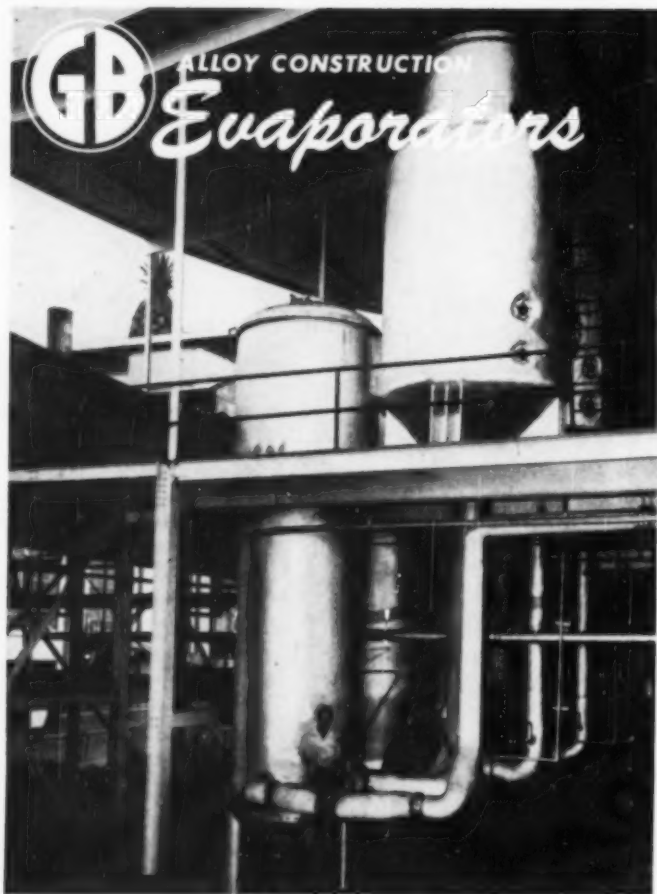
Remember — when you have a requirement involving automatic voltage regulation — you're assured of the following characteristics only in a STABILINE Type IE and found in every standard STABILINE Type IE — "built-in" by SUPERIOR ELECTRIC: Completely electronic operation; waveform distortion never exceeds 3%; stabilization of ± 0.1 of 1% of preset value; regulation of ± 0.15 of 1% for any load current change from zero to full load, or any load power factor change from 0.5 lagging to 0.9 leading.

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THE SUPERIOR ELECTRIC CO.
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POWERSTAT VARIABLE TRANSFORMERS • VOLTBOX A-C POWER SUPPLIES • STABILINE VOLTAGE REGULATORS



Many new process developments necessitate alloy construction to assure freedom from corrosion and product contamination. In the Hawaiian Pineapple Company's efficient, modern plant, the Goslin-Birmingham quadruple effect evaporator, one view shown above, plays a part in upholding their high standards of purity.

Some of the features of installation are—

- All Type 316 Stainless Steel construction
- Ample capacity for peak loads
- No entrainment losses
- Fully automatic operation

If special alloy construction will improve your product or reduce costly replacements, be sure to call on G-B's highly skilled engineers for recommendations. Your inquiry will receive prompt attention.

GOSLIN-BIRMINGHAM MANUFACTURING COMPANY, Inc.
BIRMINGHAM, ALABAMA

NEW YORK: Goslin-Birmingham Mfg. Co., Inc., 350 Madison Ave., N. Y. 17
CHICAGO: F. M. Sellers and Assoc., 20 N. Wacker
HAWAII: P. S. Pell and Company, Honolulu 8

EVAPORATORS. CONCENTRATORS. CONDENSERS. FLAKERS. FILTERS.
STANDARD AND SPECIAL EQUIPMENT FOR CHEMICAL PROCESS INDUSTRIES



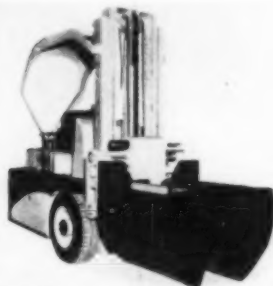
NEW EQUIPMENT, CONT.

in stripping the sheet from the roll after the cut is made. Such rolls are now said to be producing a variety of products including fiber board, binders board, brake and clutch lining stock, asbestos-cement products, etc.



NON-ELECTRIC:
Magnetic Pulley

The Homer Mfg. Co., Lima, Ohio, has supplemented its line of permanent magnetic separators with a series of permanent magnetic pulleys comprising 57 standard sizes ranging in diameter from 12 to 30 in., for belt widths from 4 to 60 in. The manufacturer claims that these pulleys equal or exceed the strength and performance of an electromagnet pulley of the same size and capacity. Suitable for all sorts of tramp-iron removing operations, they are crowned to prevent belt weaving and run-out.

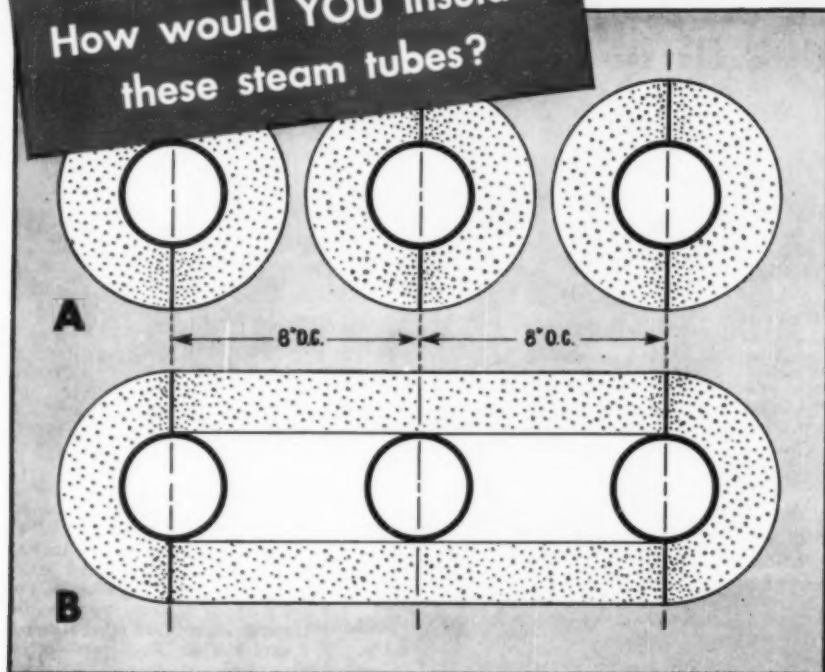


ADDS UTILITY:
Fork Truck Bucket

The Hyster Co., Portland 8, Ore., has developed a $\frac{3}{4}$ cu.yd. capacity clamshell bucket for attachment to its Hyster 40 lift trucks. Such bulk materials as sand, chemicals, fertilizers and insulating materials can be handled and lifted to a height of 84 ft. for loading and unloading operations. The clamshell is opened and closed by the same hydraulic power system which spreads and contracts the arms of the standard load-grab palletless handling mechanism employed on this truck.

(Continued)

How would YOU insulate these steam tubes?



These 3 1/2\" down-take tubes connecting the lower drum with the bottom waterwall headers operate at 375° F. Specifications call for 2\" of 85% Magnesia insulation with sewed canvas finish. Would you insulate each pipe individually, as shown at A, or would you box them in with half sections of pipe covering on the ends, and block insulation between, as shown at B?

HERE'S WHAT THE ARMSTRONG ENGINEER RECOMMENDED:

In this case the Armstrong Engineer recommended Method B. His calculations showed that from a material and labor cost standpoint it would be less expensive to insulate the three tubes as one unit. Method B also cuts down the amount of insulation surface from which heat is lost by radiation. As there is practically no maintenance on tubes of this kind, the fact that Method A allows for easier access for repair work did not have to be considered.

Had the tubes been spaced several

inches farther apart, or if maintenance had been a problem, then Method A would have been the most practical to use.

Often, the dividing line between two methods of solving a certain insulation problem is pretty finely drawn. When these cases present themselves, Armstrong engineers take pride in their ability to arrive at a specification which will provide the best job. If you consult the Armstrong Office nearest you before planning your next insulation job, they will be glad to offer you

their thinking on any problems you may have. Their solutions can often save you time and money.

FREE BOOKLET

Write today for your free copy of the 28-page booklet, "Armstrong's Industrial Insulations." This booklet contains specifications for application of both heat and low-temperature insulations and an insulation chart listing types and thicknesses of insulation for all temperatures. Write to Armstrong Cork Company, Industrial Insulation Dept., 3306 Maple Ave., Lancaster, Pennsylvania.



ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service
For All Temperatures

From 300°
Below Zero

To 2800°
Fahrenheit

When good eye protection . . . is no good at all!

This is a common sight in many plants—a condition that contributes to top-heavy accident rates, compensation costs and to lags in production.



Cover-All® Goggles
Style CC60

Wearing comfort, more than anything else, will move safety goggles off the forehead on to the eyes. In Cover-All® goggles, as in all WILLSON protective equipment, comfort plays a big part in their design. The large, deep eyecups allow plenty of room for wearing prescription spectacles—and they are molded with rolled edges to fit facial contours around the eyes. The soft, leather bridge adjusts to the correct distance between the eyes and the adjustable headband provides for proper head size.

Don't fail to consider personal comfort if you want eye safety equipment worn as intended.



WILLSON

"Established 1870"

WILLSON PRODUCTS, INC., 223 WASHINGTON STREET, READING, PA.

DAILY REMINDERS

Such as Willson "Blind Man" safety posters keep workers in hundreds of plants aware of the need for personal safety measures. Supplies are available on request.



WEAR YOUR SAFETY GOGGLES



NEW EQUIPMENT, cont. . .

This company has also announced a revolving apron attachment suitable for use on its Hyster 20 and 40 lift trucks. Equipped with a special load-grab unit on the turntable in place of the regular fork arms, this device can be used for picking up bales, boxes, drums, barrels and other packages for which various specialized arms are available.



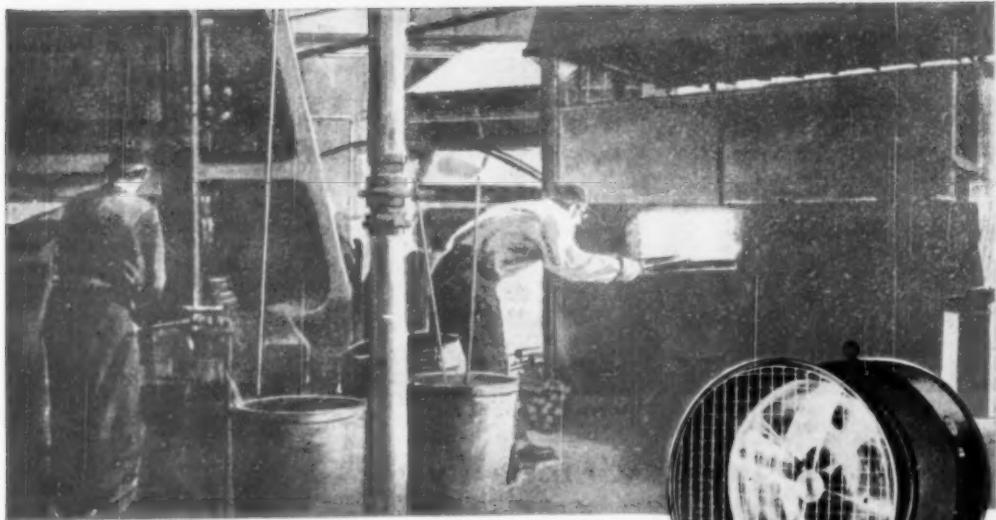
LIGHT, PORTABLE:
Barrel-Type Pump

Lear, Inc., Romee Pump Co. Div., Elyria, Ohio, has announced its new Utility Master hand-operated barrel-type pump for handling either light or heavy liquids including oils, gasoline, kerosene, solvents and other materials at capacities of 10 gal. per 120 rev. The pump consists of a cylindrical casing containing an eccentric rotor and four sliding blades. All necessary accessories for pumping from barrels are available. The pump is of zinc die castings with a stainless steel four-blade rotor shaft, and a special seal easily replaceable from the outside. Ports are of 1-in. size. Lifts up to 20 ft. can be handled, depending on the volatility of the liquid.



PREVENTS STRAINS:
Drum Truck

Ernst Drumobile Div., Brantwood Products Co., 115 Brayton St., Buffalo 13, N. Y., is offering an improved
(Continued)



COOL HEADS IN "HOT SPOTS" WON'T LET YOU DOWN

On jobs where the air is foul or hot, men can't be blamed too much for letting up now and then. If you want to keep their efficiency and morale high, feed them better air.

Employers have learned the value of putting Coppus Blowers and Ventilators on the job . . . in confined areas and near furnaces or hot processes. The men work faster, do better work, work longer without fatigue — and appreciate the more comfortable working conditions.

Give some thought now to the "hot spots" in your plant. There is a

Coppus Blower for practically any requirement — Cable Manhole and Tank Ventilators, Boiler Manhole Blowers and Exhausters, Heat Killers, Shiphold Ventilators, etc. The Coppus "Blue Ribbon" is your assurance of design and construction planned for plenty of severe service. Check and mail the coupon for specific information. Coppus Engineering Corp., Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.



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Please send me information on the Blowers that clear the air for action.

☐ in tanks, tank cars, drums, etc.

☐ in underground cable manholes.

☐ in aeroplane fuselages, wings, etc.

☐ on cable cranes.

☐ on steam-heated rubber processes.

☐ on boiler repair jobs.

COOLING:

☐ motors, generators, switchboards.

☐ wires and chests.

☐ general man cooling.

☐ around cracking stills.

☐ exhausters, welding fumes.

☐ stirring up stagnant air wherever men are working or material is drying.

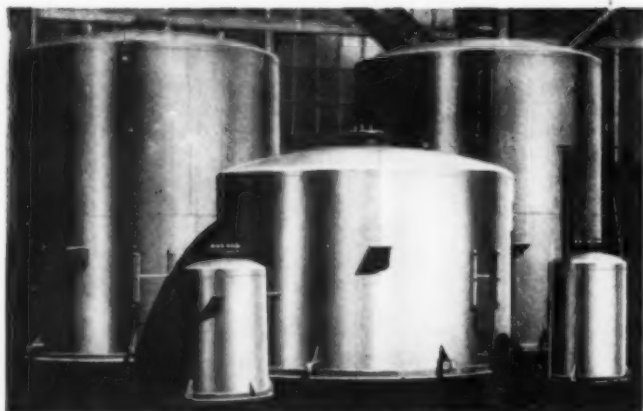
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COMPANY

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CITY

(Write here any special ventilating problem you may have.)



Stainless steel pulping vessels, fabricated by Birtank for a leading soap manufacturer.

USEFUL • ECONOMICAL • LONG-LIVED

Stainless Steel Vessels

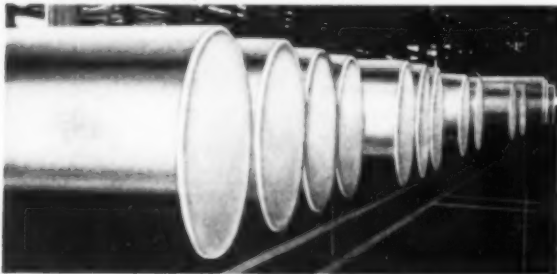
FABRICATED BY



Industrial users of steel containing vessels should consider the many advantages of all-welded stainless steel vessels, fabricated by Birtank.

No other metal affords the variety of processing and storage uses, the economy of operation and maintenance, and the long life under corrosive conditions as does stainless steel. Birtank will fabricate solid stainless or stainless clad vessels to meet your requirements—in any type or quantity. Our experienced engineering staff will help in vessel design and selection of the proper materials. Efficient service, prompt delivery.

Write, wire or telephone.



A view of the tank assembly line at our North Birmingham plant. The tank rolls accommodate vessels up to 30 feet in length.

BIRMINGHAM TANK COMPANY

Division of

THE INGALLS IRON WORKS CO.

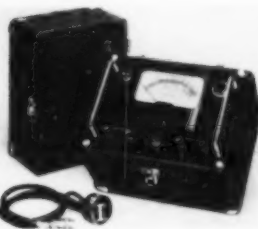
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THREE PLANTS:

Birmingham and North Birmingham, Ala.
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NEW EQUIPMENT, CONT.

model of the device formerly known as the Ernst Carrier, to which the name of Drumobile has been given. This device carries drums and barrels up to 850 lb. in weight in a vertical position without requiring the drum to be touched by human hands. Thus, even open containers can be carried without risk of spilling. The device is provided with three wheels and is said to be readily maneuverable since it is scarcely wider than the drum and is provided with a free-swinging steering column.



**NON-DESTRUCTIVE:
Coating Thickness Gage**

Branson Instruments, Inc., Stamford, Conn., has developed the "Coatingage," an instrument for measuring the thickness of non-magnetic coatings on iron or steel. The device is non-destructive and shows thicknesses directly on the meter of the instrument, handling a range from 0.0001 to 0.50 in. The device employs a detecting head containing a coil connected into a bridge circuit. The coating thickness is measured by the effect of changes in the reluctance of the magnetic circuit. The instrument used with the head is portable, contains its own battery power supply and weighs only 10 lb. Accuracy is within 10 percent of the actual thickness.



**FINDS FIRES:
Smoke Detector**

Walter Kidde & Co., 140 Cedar St., New York, N. Y., has now introduced an industrial version of the marine type smoke detector made by
(Continued)

ATLANTIC

PETROLEUM CHEMICALS

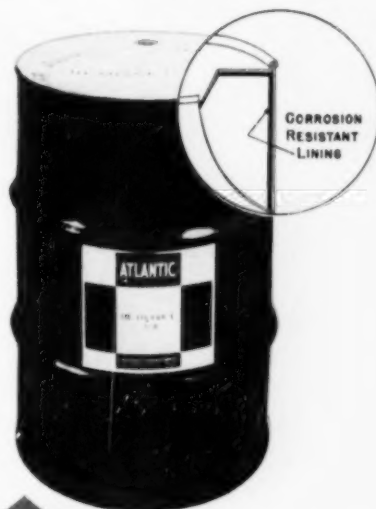
ULTRAWET 30E

Why you should select this
ULTRAWET for your job

Crystal-clear, pale-yellow *ULTRAWET 30E* is a liquid of pleasant odor containing 30% solids of which a minimum of 85% is active alkyl aryl sulfonate. It is used—economically—as a wetting agent in textile, paper, leather and many other industrial wet processes . . . for solubilizing and coupling . . . and in emulsion breaking applications.

Its moderate foam and acid, alkali and hard water stability make it particularly useful in these industrial applications. *ULTRAWET 30E* remains crystal-clear above 65 degrees F, which eliminates mixing prior to use.

ULTRAWET 30E—like all liquid *ULTRAWETS*—is shipped in special lined drums, tank trucks and tank cars. This protective lining insures purity of these liquid *ULTRAWETS* when you receive them.



● APPLICATIONS	● ULTRAWETS					
	30E Liquid 30 85	30DS Liquid 30 85	35K Liquid 35 90	SK Bead 35	DS Flake 35	K Flake 35
EMULSION BREAKING	✓					
LIGHT-DUTY HOUSEHOLD DETERGENTS			✓	✓		
PENETRANT	✓	✓				
INDUSTRIAL DETERGENTS					✓	✓
HEAVY-DUTY HOUSEHOLD DETERGENTS			✓			✓
EMULSIFIER					✓	✓
WETTING AGENT	✓	✓				
CHARGE STOCK FOR SPRAY AND DRUM DRYING			✓			
DRY MIXING WITH ALKALIS				✓	✓	✓
LIQUID HOUSEHOLD DETERGENTS		✓				
COUPLING AND SOLUBILIZING	✓					



A new, illustrated 40-page brochure on the performance and application of the *ULTRAWETS* is available free of charge. Write for "ULTRAWETS" brochure on your firm's letterhead. Please address your request to the Atlantic Chemical Products Division office nearest you.

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NEW EQUIPMENT, CONT.

this company since 1917. This device, used as an adjunct to various fire-fighting systems, can detect smoke in any part of an industrial plant, and give an early warning of incipient fires. It is claimed that such devices often detect fires before thermostatic or heat actuator alarms are affected. The device draws a continuous sample of air from the protected space through an analyzer tube which filters out dust and dirt. The sample then passes through a beam of light focused on a photo-electric cell which immediately sets off an alarm if smoke reduces the light transmission. If desired, the smoke detector circuit can be tied in with controls to operate ventilating dampers, door-closing releases, or electrical equipment power cut-off.

CUTS LIFTING:

Elevating Platform

Lyon-Raymond Corp., 1614 Madison St., Greene, N. Y., has announced a flush-with-floor type hydraulic elevating platform which is 30 in. square and elevates from the floor level to 24 in. A load of 2,000 lb. can readily be elevated by means of the single-speed hydraulic foot pump which is provided. If desired, elevation up to 36 in., platforms up to 36 in. square, and a power-operated pump can also be secured. For safety the platform incorporates toe guards on all four sides.

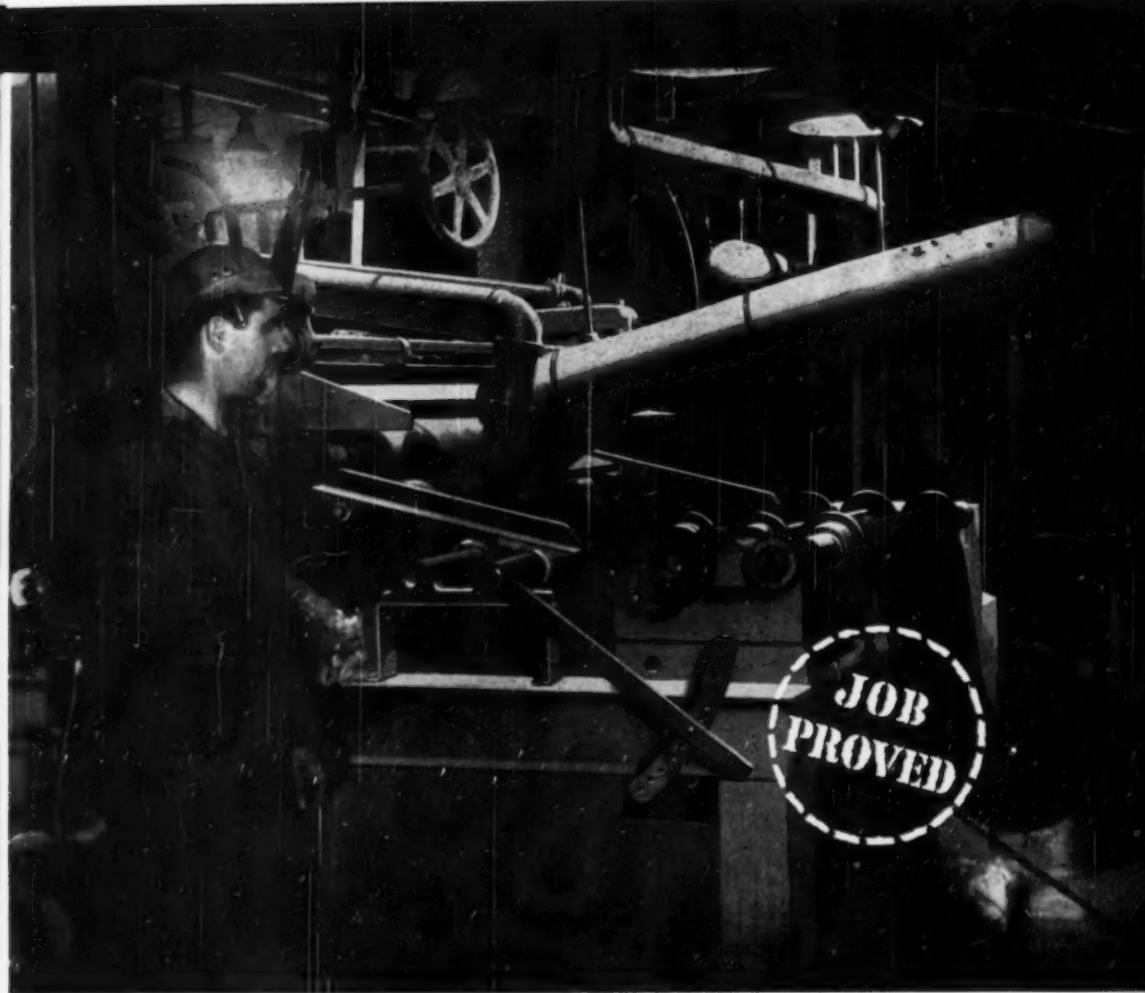


SPEEDS MIXING:

Pilot Plant Dissolver

The Cowles Co., Cayuga, N. Y., has added a new small model, known as the "Tipup" to its line of dissolving equipment. This agitator, designated as Model 5VT, is equipped with a 3-hp. motor and a variable-speed drive for viscosities ranging up to 40,000 cp. Depending on flow characteristics of the materials processed, batch capacities from 2 to 40 gal. can be handled. The dissolver is intended

(Continued)



THREAT OF 3-DAY SHUTDOWNS ELIMINATED

Circo XXX Forms No Hard Sludge, Permits Maximum Rate of Heat-Transfer, Saves \$2,000 Worth of Oil

Production lagged in an asphalt plant. The two 2,000-gallon heat-transfer absorbers were losing efficiency because of an unstable circulating oil. At high temperatures it broke down and formed deposits which insulated the walls of jackets and pipes, retarding heat flow. Frequent oil changes, with 3-day shutdowns, would have been necessary to maintain efficiency.

On the recommendation of a Sun Engineer, the company switched to

Circo XXX Heat-Transfer Oil. Four years have passed and the same charge is still in the system. Tests show no appreciable deterioration. In fact, the customer believes no oil change may ever be required. Because of its solvent properties, Circo XXX removes deposits—permits maximum heat-transfer, on which peak production depends. The lines never have to be cleaned, and oil savings alone have amounted to at least \$2,000.

Circo XXX is a high-flash-point oil of excellent thermal stability. It resists sludging, causes no fire hazard, forms no hard carbon. It has been safely used in closed systems at a temperature of approximately 600 F. At heat of starting, it can be easily handled by any type of pump. For an illustrated bulletin on the fundamentals of heat-transfer systems and complete information about this outstanding oil, write to Dept. CE-6.

SUN OIL COMPANY • Philadelphia 3, Pa.
in Canada: Sun Oil Company, Ltd., Toronto and Montreal

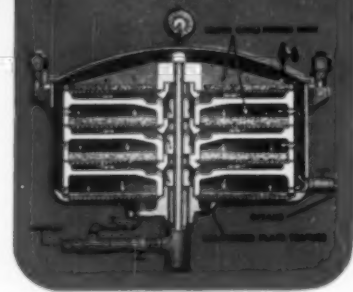
SUN PETROLEUM PRODUCTS

"JOB PROVED" IN EVERY INDUSTRY



why

Horizontal Filter Plates?



because—with horizontal plates, filter aids are permitted to flow in a natural direction, with gravity, and are deposited in an even cake of uniform thickness.

because—the filter cake rests flat on the supporting plate without tensile or distortive strain, will not crack, slip, or break under pressure, assuring even filtration.

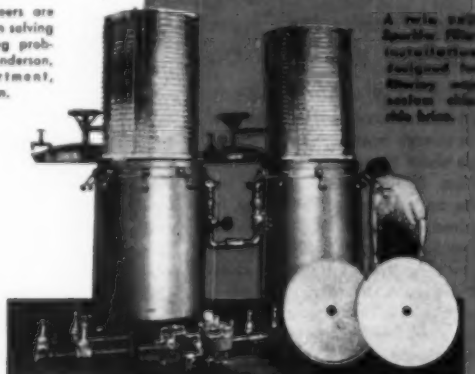
because—any filter paper, cloth, screens, or filter media can be used. Strength in the cake itself is not important, pressure simply presses the cake more firmly on the supporting horizontal plate.

because—horizontal plates are bolted together in a unit that is easily removed for cleaning. An extra unit assembly of horizontal plates can be immediately placed in the filter and the filtering process continued with slight interruption.

This is only part of the story—other exclusive features like the patented scavenger plate that makes possible the recovery of the last of a batch run and other operating advantages are reasons why Sparkler Horizontal Plate Filters are so widely used in the chemical processing industry.

SPARKLER *horizontal plate* FILTERS

Our filtration engineers are ready to cooperate in solving any of your filtering problems. Write E. S. Anderson, Industrial Department, for personal attention.



SPARKLER Manufacturing Co., 100 Lake Street, Springfield, Ill.

NEW EQUIPMENT, CONT.

for use in containers brought to the machine, the impeller being immersed or removed from the tank simply by tilting the bridge carrying the impeller, drive and motor. Counterbalancing springs serve both as snubbers and as boosters to facilitate tilting. The machine provides a wide selection of sheave ratios and speeds, and permits the use of 4-, 6-, or 8-in. impellers which, in general, are operated at rim velocities from 2,500 to 5,000 ft. per min.

CLARIFIES, POLISHES: Sterilizing Filter

F. R. Hormann & Co., 186 Joralemon St., Brooklyn, N. Y., has introduced a new series of pressure sterilizing filters to which the name Sanitype has been given. These filters are designed to clarify, polish, and sterilize all types of pharmaceutical solutions and medicinal preparations, including serums, vaccines, antibiotics, vitamins and various solutions. All parts coming in contact with the liquid are smooth and highly polished, as are the external surfaces. The filter eliminates unnecessary threads, welds, cracks or joints, which facilitates cleaning and eliminates contamination. Double or triple filtration can be accomplished with the same unit by adding one or two bypass plates, thus permitting clarification and sterilization in a single operation.

EFFICIENT, CLEANABLE: Freon Condenser

The Doyle & Roth Mfg. Co., 10-15 49th Ave., Long Island City, N. Y., has introduced a new line of "Junior" Freon condensers for air conditioning and refrigeration applications in capacities from 1½ to 25 tons. These condensers are available from stock and employ tubes rolled into reamed and serrated holes to insure tight, leak-proof construction. The tubes are cleanable, and easy to remove and replace. They are said to give high heat transfer owing to the use of the company's special "lo Fin" tube.

Briefs . . .

COMBUSTION CONTROL. Ess Instrument Co., 96 West Washington Ave., Bergenfield, N. J., has modified its Hazegage combustion indicator, so as to give automatic control. This device uses an electric eye to measure the haze density, as an accurate index of the CO₂ content of the gases. At either too high or too low a haze reading, re-

(Continued)

what chemists see in

cmc

more

CMC, Cellulose Gum, is now available from Hercules in purified and technical grades. Recently expanded production facilities assure adequate supplies of both grades to meet all requirements.

versatile

Cellulose Gum can be readily dissolved in either cold or hot water to form colloidal and highly viscous solutions, possessing marked suspending, thickening, stabilizing, and film-forming properties.

applications

CMC's versatility is utilized by many industries such as detergent, paper, textile, printing, pharmaceutical, cosmetic. Write for new book and test sample. If possible, specify type and grade.



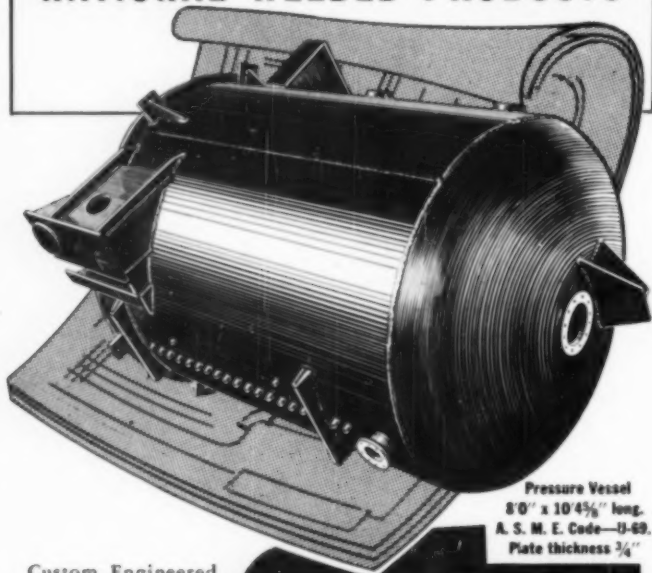
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- Tin Pots
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- Wire Annealing Pots
- Special Plate Work

NEW EQUIPMENT, CONT. . .

lays operate a reversible motor to correct the air ratio and return it to the zone of good combustion.

AGITATOR DRIVE. New England Tank and Tower Co., 87A Tileston St., Everett, Mass., has improved its Nettco agitator drive for extra protection against leakage and shaft scoring. The new design incorporates John Crane mechanical seals to eliminate leakage and protect products from contamination. The seal is now standard on several of this company's drives.

COOLING TOWER. The Marley Co., Kansas City, Mo., has announced a new small Aquatower of 7 1/2-ton size, increasing this series of compact, all-steel cooling towers to eight sizes. These small towers are carried in stock and available for immediate shipment.

STEAM GENERATOR. Preferred Utilities Manufacturing Corp., has announced a new fully automatic combination unit steam generator in which it is possible to change from gas to oil or vice versa within a few minutes. The change is accomplished by swinging the oil burner open and inserting a primary gas burner. This burner handles from 25 to 30 percent of the total heat input and is supplemented by a main gas burner in the form of an annular ring which is always in place inside the furnace extension.

IMMERSION HEATERS. Electro-Therm, Inc., 8024 Georgia Ave., Silver Spring, Md., is offering a new line of electric immersion heating units for a variety of acid solutions. These units are sheathed in Carpenter Stainless No. 20, are rated at from 200 to 5,000 watts, and are produced in straight lengths up to 176 in., for bending to a minimum radius of 1 1/2 in. They can thus be shaped according to the user's requirements.

CO DETECTOR. The United States Safety Service Co., 1215 McGee St., Kansas City, Mo., is now marketing a simple carbon-monoxide indicator, developed by the National Bureau of Standards. The detector is about the size of a pencil, and is said to detect and closely estimate less than 1 part of carbon monoxide per 500,000,000 parts of air. The detector employs a sealed tube through which the air sample is drawn, after the tube tips are broken off. The color change indicates CO concentration.

—End

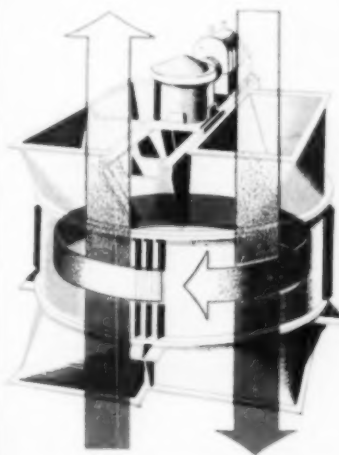
Fact File on Preheat

No. 3

The regenerative principle of heat exchange favors a high ratio of effective surface area to unit volume. In the Ljungstrom, this is accomplished by a compact arrangement of heat-transfer elements.

All the characteristics of the Ljungstrom's rotating heat-transfer unit—its surface area, size and shape of passages, and counterflow arrangement—act to obtain maximum heat recovery for the unit's size and weight.

LJUNGSTROM



The Ljungstrom Air Preheater is a compact gas-to-air or gas-to-gas heat exchanger, operating on a continuous regenerative counterflow basis. Hundreds of leading power plants and other special applications confirm its high level of heat recovery and long-term low maintenance service.

THE AIR PREHEATER CORPORATION

60 EAST 42ND STREET • NEW YORK 17, N. Y.

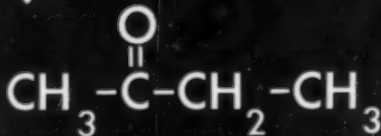
Plant: Wellsville, N. Y.

1284

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solvent...
Efficient
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intermediate...

METHYL ETHYL KETONE



FOR SURFACE COATINGS—MEK has exceptional solvency for cellulose esters, acrylics, vinyl resins, and other surface coating materials.

FOR PAPER AND TEXTILES—MEK is an effective solvent for vinyl copolymers and other resins . . . giving solutions of high solids content, for use in roller and knife coating formulations.

FOR ADHESIVES—in the preparation of tough, water-resistant cements utilizing synthetic rubbers and resins, MEK contributes fast-evaporating characteristics for early development of bonding strength.

FOR CLEANING AND DYEING—MEK is useful in paint and varnish removers and metal surface cleansers . . . is a valuable solvent for dyes and their intermediates.

FOR REFINING AND PROCESSING—Widely used as the wax precipitant in lubricating oil refining . . . helps effect a high yield of low pour-point oil. An efficient extractant . . . low in toxicity, inert to metals, chemically stable and easily recovered.

FOR CHEMICAL SYNTHESIS—MEK lends itself to diverse types of syntheses through reactions of both the carbonyl group and the adjacent hydrogen atoms . . . has high potentiality as an intermediate for the manufacture of resins.

PROPERTIES

Molecular Weight	72.10
Specific Gravity 20°/4°C	0.8047
Boiling Point (760 mm.)	79.6°C
Freezing Point	-86.4°C
Vapor Pressure at 20°C	71.2 mm. Hg
Refractive Index, n _D ²⁰	1.3788
Solubility at 20°C—in water	27.0% wt.
water in	12.5% wt.

LACQUER SOLVENT PROPERTIES

Dilution Ratio	
Toluene	4.6 ¹⁰⁰
^a Aromatic Petroleum Naphtha	3.2 ¹⁰⁰
Aliphatic Petroleum Naphtha	1.1 ¹⁰⁰
Viscosity (8% RS 1/2 second Nitrocellulose solution at 25°C)	10 centipoises
Blush resistance (% relative humidity at 80°F)	45%
Rate of evaporation (normal butyl acetate = 1.0)	4.6

^aContaining approximately 70% aromatics.
¹⁰⁰For a mixture of 75% methyl ethyl ketone and 25% low-boiling alcohol.

A sample of Methyl Ethyl Ketone will be forwarded promptly following your letterhead request.



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New Products and Materials

JOSEPH A. O'CONNOR, Assistant Editor

FOR SELECTIVE OXIDATION:

Lead Tetra-Acetate

Arapahoe Chemicals, Inc., Boulder, Colo., is now turning out lead tetraacetate, $Pb(C_2H_3O_2)_4$ in moderate commercial quantities. Lead tetraacetate has long been used as a specific reagent for splitting glycols into two molecules of aldehyde.

In addition to splitting glycols, the reagent also splits alpha-hydroxy acids, alpha-amino acids, 1,2-amino alcohols, and 1,2-diamines in analogous fashion. Product of cleavage at the amino-carbon atom is an imine rather than an aldehyde. This imine is usually further dehydrogenated to the nitrile. This last step may be avoided, and the imine isolated, if the amino group is first protected by acylation. A less known reaction of lead tetraacetate is the introduction of the acetoxy group (CH_3COO-) into olefins and certain compounds which contain a labile hydrogen atom. Summary of the reactions of this compound is contained in a data sheet available from Arapahoe.

Lead tetraacetate is supplied in the form of white to pink crystals moistened with glacial acetic acid, active ingredient 85-95 percent. The manufacturer points out that the compound is not indefinitely stable to storage and should, therefore, be ordered for immediate use.

STABLE ISOTOPES:

Elemental Boron

U. S. Atomic Energy Commission, Isotopes Division, Oak Ridge, Tenn., is now making available for research purposes concentrated elemental Boron 10.

The material is in the form of a powder with particle size the order of 200 mesh. It is composed of 98 percent boron with 2 percent impurities of iron, magnesium and silicon. The boron contains approximately 96 percent boron 10.

Price of the elemental boron 10 is \$15 per gram, postage prepaid. It is packaged to order in quantities of 1 gram or more.

The U. S. Atomic Energy Commission also has boron 10 available in the form of the solid complex boron trifluoride calcium fluoride for other uses, such as for neutron counter production.

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Only a limited quantity of elemental boron 10 is available. An applicant should state the amount required for the proposed investigation, and should clearly justify the expenditure of the material. Allocation approvals will be based upon the information furnished.

Applications for elemental boron 10 should be submitted on Stable Isotopes Request, AEC Form 100, to the U. S. Atomic Energy Commission, Oak Ridge, Tenn., Attention: Isotopes Division. Sets of Form 100 are available from the same agency.

Carbide & Carbon Chemicals Corp., Oak Ridge National Laboratory, Oak Ridge, Tenn., will act as the supplier. Purchase order should not be placed with that firm, however, until notice is received from AEC's Isotopes Division that the request has been approved. Detailed information on elemental boron 10 and its procurement may be found in the Isotopes Division Catalog, Stable Isotopes.

ANHYDROUS:

Hydrazine

Mathieson Chemical Corp., 60 East 42nd St., New York 17, N. Y., is now producing hydrazine in anhydrous form. Small quantities of hydrazine sulphate are also being made.

Operation of the plant turning out these products is the result of a contract with the Army Ordnance Department, but limited amounts are

also being supplied to commercial interests for test purposes.

Many potentially valuable commercial uses are being investigated. Patents already issued suggest that the products may find application in the manufacture of insecticides, bactericides and plastics, as well as in textile processing. Also, since hydrazine is of value in chemical laboratories as an analytical reagent and in the production of organic intermediates, it is probable that similar uses on a commercial scale will be developed as the compound increases in availability.

NON-SLUDGING:

Synthetic Lubricants

Carbide & Carbon Chemicals Corp., 30 E. 42nd Street, New York 17, N. Y., has recently placed its new series of Ucon fluids and lubricants in commercial production. These are synthetic oils which have excellent low temperature properties, and they do not form sludges.

Chemically, Ucon lubricants are a series of synthetic organic chemicals of the polyether type. They are classified as polyalkylene glycols and derivatives. They differ both chemically and in performance characteristics from petroleum oils, animal and vegetable oils, silicones and other synthetic oils.

Ucon synthetic lubricants are comparable to high grade petroleum oils, but they do not contain petroleum oils and they are also wax free. They are excellent lubricants, remaining sludge-free for long periods. Ucon lubricants change little in viscosity over wide ranges of operating temperatures. Important to those who must lubricate machines that contain rubber parts, moreover, is the minimum effect that these lubricants have on most natural and synthetic rubbers.

Ucon lubricants have little or no effect on most natural and synthetic rubbers and common gasket materials. Under ordinary conditions of use, they are inert to the most generally used metals, including iron, steel, copper, bronze, brass, aluminum, magnesium and bearing alloys. Consequently, Ucon lubricants can be used in practically any existing machine or hydraulic system.

These fluids have good overall load-carrying capacity and anti-wear char-

(Continued)

Silicone News



DC Antifoam A eliminates bottleneck in synthetic rubber plant

Engineers spend thousands of man-hours designing new processing plants to secure efficient production at maximum capacity. But foaming can limit the capacity of even the most carefully designed processing plant. That's where DC Antifoam A pays double dividends.



Synthetic rubber plants increase efficiency by using DC Antifoam A to eliminate foam during processing.

In the production of Buna S at the Akron Plant of Firestone Tire and Rubber Co., foaming during the early post-polymerization treatment of the latex caused serious operating difficulties. Production could be maintained only at the expense of appreciably lowered material efficiencies.

Firestone engineers tried many foam inhibitors to eliminate this bottleneck. Some defoamers didn't work at all, others were too slow, and some were effective only in such high concentrations that they contaminated the product. Firestone engineers then tested a sample of the silicone antifoam agent introduced by Dow Corning. They found that a concentration of only 20 parts of DC Antifoam A per million was required to prevent foaming of GR-S latex. Use of DC Antifoam A has substantially increased efficiency during the past two years by permitting maximum use of production equipment. Firestone's experience has been duplicated in many processing plants where DC Antifoam A is used in concentrations ranging from 1 to 5,000 p.p.m. Typical applications include: the concentration of caustic soda; the cooking of oils, resins and varnishes; rendering fat, and the processing of pharmaceuticals, soap, wine, tallow, cane and corn syrup. For more information about DC Antifoam A, phone our nearest branch office or write for catalog No. B506.

DOW CORNING CORPORATION MIDLAND, MICHIGAN

Atlanta • Chicago • Cleveland • Dallas
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In Canada: Fibreglass Canada, Ltd., Toronto
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NEW PRODUCTS, cont.

acteristics as demonstrated by laboratory tests and service experience. If desired, they can be compounded with additives to produce lubricants suitable for use under conditions of extreme pressure or requiring improved film strength, rust-preventive properties, or other desired characteristics.

The new synthetic oils have been used successfully in oiling kiln car wheels and axles. These kiln cars carry vitreous china fixtures through large baking ovens. One company using Ucon lubricants has reduced the oiling cycle from two oilings per trip through the kiln to one oiling every two weeks with less trouble from excess wear on the bearing. A trip through the kiln takes about two days.

At present four series are available. The LB and D series are water insoluble, whereas the 50-HB and 75-H series are water soluble. Water solubility is particularly valuable when the lubricant must be applied in one step of a manufacturing process, and then removed prior to another. All these lubricants are soluble in most organic solvents. These lubricants range from light to highly viscous liquids, and are available with or without additives.

BUILDING BLOCKS:

A Trio of New Organics

B. F. Goodrich Chemical Co., 324 Rose Building, Cleveland 15, Ohio, announces the availability, in experimental quantities, of three new chemicals not previously disclosed in the literature.

The first, (benzothiazyl-2)-carboxyethyl sulphide, has a low water solubility, molecular weight 239, melting point 139-141 deg. C. This sulphide can be recrystallized from alcohol. It is light buff-colored and dissolves readily in sodium hydroxide solution. It is reprecipitated by the addition of acid.

Next of the newcomers is β -isothionureido propionic acid. This chemical can be recrystallized from water and is obtained as a hydrate or in anhydrous form, depending on the drying conditions used. It has a molecular weight of 148, melting point 170-180 deg. C. and is supplied as a white, crystalline anhydrous substance.

Third of the new compounds is β -dithiocarbamyl propionic acid. This product has a low water solubility and can be recrystallized from an ether-petroleum ether solution. It is white, crystalline, has a molecular weight of 165 and melting point of 124-126 deg. C. It dissolves readily in sodium hydroxide solutions and is reprecipitated by the addition of acid.

A zinc salt can be formed by adding a water solution of a soluble zinc salt,

such as zinc chloride, to a water solution of the ammonium or an alkali metal salt of β -dithiocarbamyl propionic acid. The zinc salt is a white solid melting at 145 deg. C., at which temperature it decomposes. The zinc salt will react with amines, such as cyclohexylamine, to form addition complexes.

If β -dithiocarbamyl propionic acid is dissolved in alcohol and ammonia passed in, the insoluble ammonium salt precipitates. This is a white solid melting at 123-125 deg. C.

These new compounds may be expected to undergo the usual reactions of fatty acids, such as esterification, salt formation and amide formation.

Data sheet and samples are available from Goodrich.

POLYESTER:

Drying Oil Upgrader

Carbide & Carbon Chemicals Corp., 30 East 42nd St., New York 17, N. Y., has been investigating new synthetic chemicals of value in the improvement of alkyd resins and the upgrading of drying oils. As a result, a new synthetic chemical, called Dryene oil upgrader, can now be had for this application.

Dryene oil upgrader is a synthetic organic chemical developed specifically for improving or upgrading naturally occurring drying oils. It is a viscous liquid of low volatility which can be handled easily. Chemically, Dryene oil upgrader is a low molecular weight polyester.

Under the conditions of a varnish or alkyd cook, this product undergoes ester interchange and dehydration to yield a product structurally similar to that obtained from a six-carbon dienoic acid. In calculations to determine proper balance between hydroxyl and acid groups in an alkyd formulation, Dryene oil upgrader may be assumed to be an acid with a combining weight of 112.

When reacted with soft drying oils, such as soy or linseed, it yields a product with greatly improved drying characteristics. This property makes it of great interest in the modification of oils to produce alkyd resin varnishes with improved alkali and water resistance, more rapid set, improved mar resistance, and increased toughness and hardness. Theory upon which the action of Dryene oil upgrader is based: introduction of increased conjugated unsaturation into a finish formulated from a soft drying oil permits a high degree of cross-linking. This cross-linking is accomplished by the formation of carbon-to-carbon linkages rather than ester linkages, and is consequently more stable than the carbon-

(Continued)

Keep OVERPRESSURE Under Control with **BS&B** SAFETY HEADS

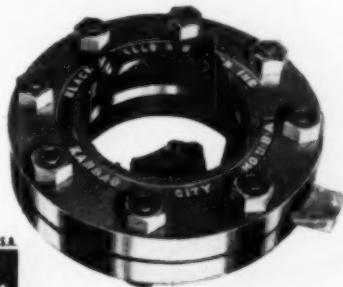
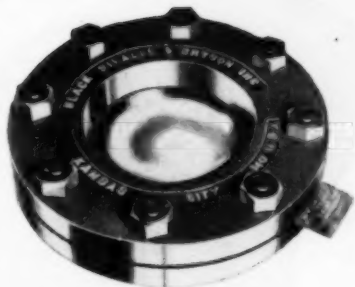
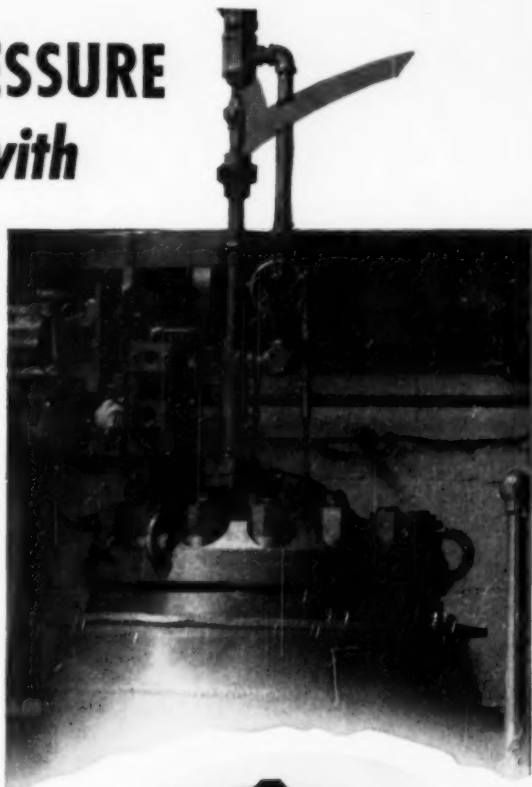
Air compressors, boilers, autoclaves—all pressure vessels contain a force which, if unrelieved, can wreak terrible destruction to life and property in an instant!

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FLORIDIN COMPANY
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Department A, 220 Liberty St. Warren, Pa.

NEW PRODUCTS, cont. . .

to-oxygen linkage typical of phthalic anhydride-glycerol alkyls.

Extensive tests have shown that such coatings have outstanding durability. Varnish coatings have been prepared which remain in excellent condition after a year's outdoor exposure, and show no sign of checking after 2,000 hr. exposure in a Weatherometer.

By incorporating Dryene in varnishes and alkyd resins, finishes with greatly enhanced properties are obtained. These finishes set and through-dry more quickly; they possess outstanding mar resistance, toughness and durability, as well as excellent resistance to attack by alkalis and moisture. Improvements in properties are obtained with baking and air-drying finishes alike.

Orders for single 55-gal. drums can be accepted now. Price applying on this quantity is 70c. a lb., fob South Charleston, W. Va. As advantages of Dryene oil upgrader are recognized by the surface coatings industry, and demand requires larger-scale production, it is anticipated that a substantial price reduction will be possible. Samples can now be secured from Carbide & Carbon Chemicals Corp.

HAS COFFEE AROMA: **Heterocyclic Mercaptan**

Cargille Scientific Inc., 118 Liberty St., New York 6, N. Y., is now furnishing alpha-furfuryl mercaptan in limited quantities for research purposes. One of the essential constituents of the aroma of roasted coffee, alpha-furfuryl mercaptan offers novel possibilities in such fields as flavors, aromas and perfumes, as a solvent, as a polymerization agent, as an intermediate for organic synthesis and as a rubber vulcanization accelerator intermediate.

Water-white in color, alpha-furfuryl mercaptan has a specific gravity of 1.132 at 20 deg. C. Its boiling point at 17 mm. is 55-57 deg. C.; its vapor tension at 20 deg. C. is 2.5 mm. The new mercaptan will not discolor, nor polymerize nor oxidize on standing. While it has the intense odor of scalions, at very low concentrations (1:1,000,000) the odor is strongly suggestive of a rich aroma of roasted coffee.

The mercaptan can be diluted with solvents and fixatives for use.

Coffee-Captan, as the new mercaptan has been dubbed by Cargille, is a unique material that offers interesting possibilities. It provides a new scent tone for perfumes and will serve to enrich flavors and aromas. Its tre-

(Continued)

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* This may be parchment paper, or various plastic films, depending upon your requirements.

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NEW PRODUCTS, cont. . .

mendous dilution factor brings the cost per unit to a reasonable level for the advantages offered in these fields.

Coffee-Captan should also interest various other fields of industry because of its unusual physical and chemical properties. It has unusual solvent properties because it has oxygen in a ring structure and is a derivative of hydrogen sulphide. Coffee-Captan will also be a useful intermediate in organic synthesis.

Still another possibility for Coffee-Captan is that of a polymerization agent and vulcanization accelerator intermediate for rubber.

Samples for research purposes are now being furnished by Cargille Scientific in prices ranging from \$3 to 10 g. to \$235 for 1,000 g. Prices on larger quantities are also quoted. The present price need not be a deterrent to consideration of Coffee-Captan for uses that require relatively low cost, because the price of Coffee-Captan will be steadily reduced as production increases.

SPEEDS REPAINTING:**Alkyd for Autos**

Resinous Products Division of Rohm & Haas Co., Philadelphia, Pa., is now offering the manufacturers of automotive refinishing enamels and similar coatings a new oxidizing type phthalic alkyd resin that possesses the advantages of fast drying speed, excellent color, high gloss and great durability.

The new resin, designated as Duraplex C-55, is designed to meet the stiff requirements demanded of paint vehicles in the countless body repair shops, paint shops and garages where winter temperatures often fall below the optimum. Enamels formulated with this resin are applicable also to fast-drying uses for farm implements, gasoline pumps, metal signs and other surfaces requiring repainting.

Air-drying enamels using the new resin will set to the touch in about 15 min., show only very slight tack after six hours, and, where two-color work is necessary, tape well after an overnight dry, even at low temperatures. This fast-drying property, naturally, gives maximum freedom from dirt collection.

In baking-type coatings, Duraplex C-55 is said to be much faster curing than conventional alkyd resins. It has been found to provide remarkable hardness when used as the sole vehicle in a white enamel baked for 30 min. at 300 deg. F. Excellent color and gloss retention are claimed for both air-dried and baked films.

(Continued)



Robins Hydrex Screen quickly removes fibrous impurities

Imagine a liquid so "tangled" with thick fibers that it plugs up purifying equipment *every fifteen minutes!*

That was the problem faced by the United South Africa Company, Guttenberg, New Jersey. Every quarter-hour, palm oil clarifiers had to be shut down for cleaning. Production came to a standstill dozens of times a day. Costs soared.

Then a small Robins Hydrex Screen was installed. And a costly "stop and go" operation changed quickly to a profitable flow. Every hour the Robins Hydrex Screen removes troublesome fiber from almost 9,000 pounds of palm oil!

This is but one example of the many industrial processes that you can simplify and speed up with Robins Hydrex Screens. You can obtain these time-proved screens in a great variety of meshes, sizes and designs. You'll find a type to meet your particular needs . . . whether you have to:

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2. Save solids from liquids.
3. Remove fines from coarser materials.

You can use them to screen materials that are hot or cold, acid or alkaline. For complete details about how they

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SCREENS

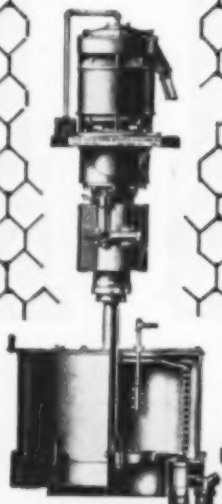
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SEND TODAY for an analysis of your particular screening problem. Get full details on how it can be solved with Robins Hydrex Screens. Address Robins Conveyors Division, 270 Passaic Avenue, Passaic, New Jersey.

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In this machine and in this machine alone are the following features to be had:

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Uniform torque ... adjustable application.

Simple adjustment for accurate speed control.

And further, the inherent design of the Roberts Fluid Drive Centrifugal allows special characteristics to be incorporated with ease, thus suiting it exactly to your individual application. Your inquiry will have our full and prompt attention.

ROBERTS

**The
WESTERN STATES
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HAMILTON, OHIO, U.S.A.

NEW PRODUCTS, cont. . .

The new phthalic alkyd resin has a solids content of 50 ± 2 percent. The solvent used with this resin is mineral spirits. At 40 percent solids the alkyd has a Gardner-Holdt viscosity of W-Y. Its acid number is 4.8, and its weight per gallon is 7.6 lb. The color on the Gardner scale ranges from 4 to 7. The phthalic anhydride content (solids) is 32 percent. This is a castor oil type alkyl.

Duraplex C-55 can be reduced with aliphatic naphtha, such as mineral spirits and V. M. & P. naphtha. It can be reduced also, of course, with aromatic hydrocarbons, chlorinated solvents, and esters and ketones.

LOW ELECTRICAL LOSS:

Aromatic Hydrocarbons

Kenrich Corp., 120 Wall St., New York 5, N. Y., is now commercially producing a new type of synthetic resinous hydrocarbon of unusual stability and extremely low electrical loss. This material is being made under arrangement with the Socony-Vacuum Oil Co., Inc., which initiated the development and is now seeking patent protection.

The hydrocarbon is produced by catalytic condensation of specific alkyl naphthalenes followed by purification and high-vacuum distillation. Offered under the trade name Kenflex, several grades are available in quantity from Kenrich's plant in Maspeth, L. I., N. Y. This plant employs stainless steel equipment.

One of the products, Kenflex A, is derived from dimethyl naphthalenes. It has a drop melting point of about 160 deg. F., a viscosity of approximately 300 centistokes at 210 deg. F., an initial boiling point in excess of 400 deg. F. at 2 mm. and a dielectric dissipation factor of about 0.0025 at 212 deg. F. Allied materials of different viscosities and melting points can be made by selection of the proper alkyl and cycloalkyl substituents. For example, Kenflex B possesses a melting point of about 80 deg. F., a viscosity of 60 centistokes, a boiling point over 400 deg. F. at 2 mm. and a dielectric dissipation factor of 0.005.

Because of their high degree of aromaticity, Kenflex products exhibit outstanding compatibility with a wide variety of resins. They have tackiness, non-volatility and electrical properties comparable to the polybutenes, but are opposite in viscosity index and solvent power. Thus, they may be blended with most oils or resins to give compositions which will impregnate or extrude easily at processing temperatures and exhibit highly viscous or tough

(Continued)

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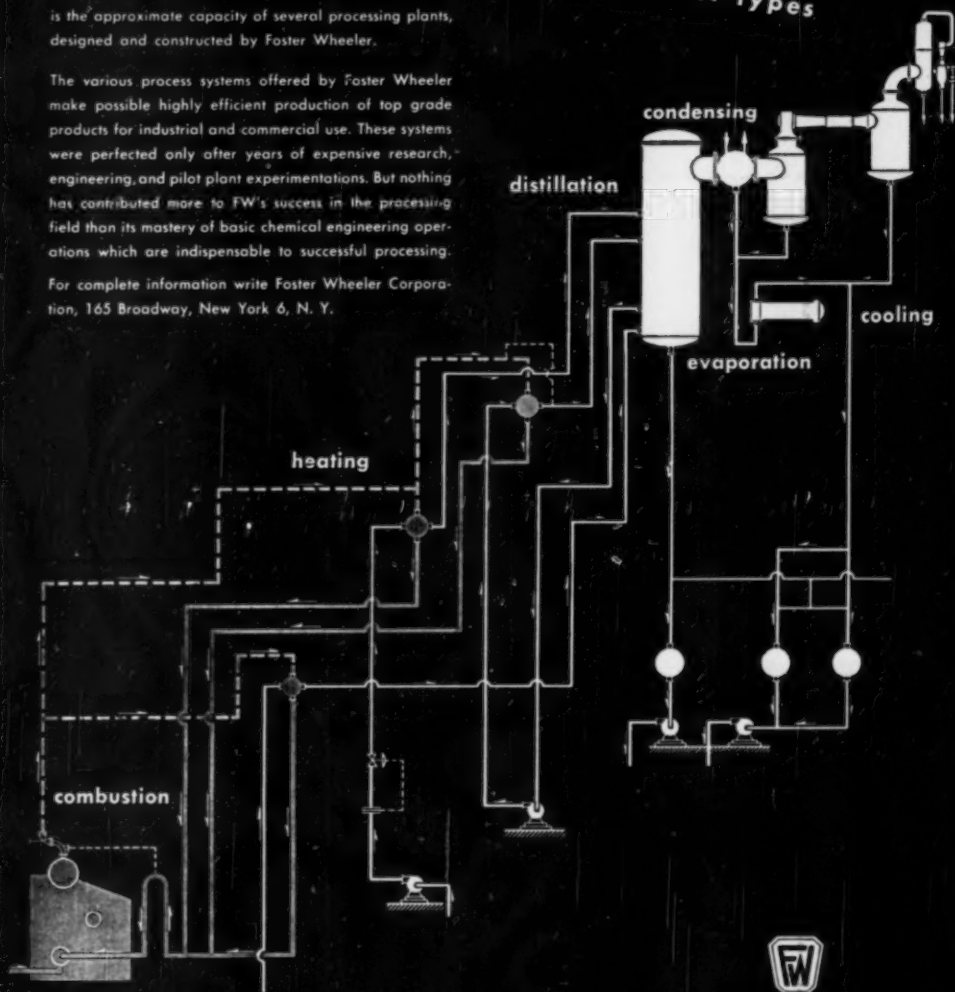
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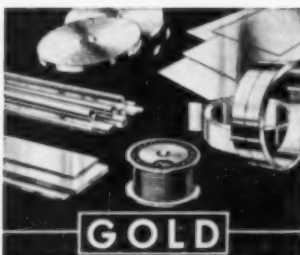
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NEW PRODUCTS, cont. . .

characteristics under usual operating conditions.

Kenflex is recommended by the manufacturer for vinyl-insulated wire, electrical cable filling, potting and caulking compounds, rigid vinyl moldings, adhesives and sealing compounds, inks, paints and varnishes, high-temperature lubricants, hot-melt coatings, insecticides, vinyl floor tile and composition rollers.

FOR DRY BLENDING:

Nitrile Rubber

B. F. Goodrich Chemical Co., 324 Rose Bldg., Cleveland 15, Ohio, is now producing commercially Hycar OR-15 nitrile rubber in powder form, designed especially for mill and Banbury blending with phenolic resins.

The first finely divided elastomeric material to be commercially available in this country, Hycar OR-15 powder is the result of a need for a material which could be successfully dry-blended and processed in an internal mixer in a minimum operation cycle. The development of Hycar powder now makes economically feasible the manufacture of rubber-phenolic molding compounds with exceptionally high impact resistance.

Recently Hycar OR-15 powder has found considerable interest in the blending of petroleum and vegetable resins as shellac replacements. Such applications indicate that there are a wide range of possible products, where the physical and chemical properties of Hycar powder will be advantageous both for processing and quality reasons.

Hycar OR-15, one of a series of oil-resistant rubbers manufactured by Goodrich, is a modified acrylonitrile-butadiene copolymer which serves as the basic material in a wide variety of products in which its superior resistance to oil, abrasion, high temperature and aging are required. Supplied heretofore in two basic forms, dry sheet rubber and latex, it is now also to be had in the new powder form in production quantities.

FAST DRYING:

Synthetic Oil

Sherwin-Williams Co., 101 Prospect Ave., N.W., Cleveland, Ohio, has developed an unusual new synthetic drying oil, partly derived from vegetable oils, which can be tailored-made to suit a wide variety of specific requirements in paint making.

Now available as High Polymer Oil No. 11, the new product was developed primarily for use as the bodied (Continued)

Announcing AUTOMATIC SHEAVE



ONE HAND
DOES IT ...
While Motor
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Varies Speed WITHOUT STOPPING

Another *Texrope* Engineering Triumph!

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SIMPLEST, most economical method of instant speed control ever devised. Simply move motor forward to increase speed and move it back to decrease. The new *Vari-Pitch* Automatic Sheave changes pitch diameter and holds belts at proper tension automatically. All other parts of the drive are standard *Texrope* V-belt drive components.

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CHEMICAL ENGINEERING—June 1949

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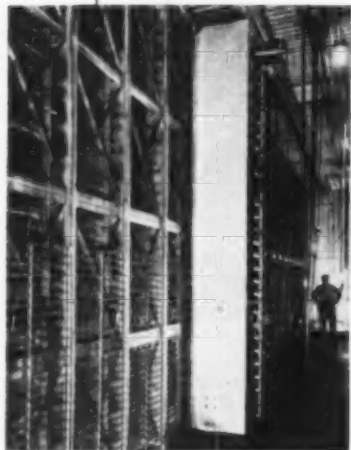


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An Electro-Cell Precipitator of 216,000 CFM capacity with AAF automatic washers, now in its third year of service at Briggs Manufacturing Co., Detroit, Mich.

AAF Electro-Cell combines high cleaning efficiency with ease of maintenance

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Removable collector plate cells permit selection of maintenance method best suited to your operation. Cells may be manually washed and re-oiled, in place; removed for easy cleaning in a special tank, or washed, dried and recoated automatically (as illustrated) with minimum interruption to operation.

Electro-Cell's sectional construction reduces weight of parts, eliminates multiplicity of electrical connections, protects wiring from dirt and water. And its full-height hinged or removable ionizers minimize electrical losses, reduce ozone and simplify replacement of ionizing wires.

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NEW PRODUCTS, cont.

portion of the vehicle in exterior paints since it overcomes some of the inherent disadvantages of bodied linseed or bodied soy-china wood combinations in this application.

Sherwin-Williams paint engineers say the new oil, when used as the bodied portion of paint vehicles, offers exceptional advantages from the standpoint of durability and package stability, through-drying, freedom from after-tack and color retention.

Because of its low acid value for an oil of this viscosity, the new product is essentially non-reactive with basic pigments. This aids in stabilizing the viscosity on aging and greatly enhances the wearing quality. Unlike many bodied oils the new oil does not surface-dry and thus decreases the tendency to wrinkle in thick films. It dries unusually fast to a firm film which has less surface tack than regular bodied oils. Further, the oil shows no tendency towards tacking back on the aging of the film so that dirt collection is minimized.

The new oil has excellent color retention properties without the disadvantages of slow-drying and after-tack. Yellowing of the paint on surfaces not exposed to direct sunlight is thereby almost negligible.

Although the new product was developed primarily for use in exterior paints, Sherwin-Williams chemists say its properties indicate it may find an important place in other coatings such as architectural whites and varnishes. Rapid drying and freedom from after-tack suggests its use in interior oil-type enamels as well as semi-gloss and flat wall finishes. It also may hold possibilities in both cold-cut and cooked varnishes.

Experience shows that it heat polymerizes more rapidly than linseed and therefore may give short cooking times. It may be blended with most oils and soluble resins.

Standard drier combinations and percentages may be used with the new oil. However, it is very responsive to lead in the presence of small amounts of cobalt. A 10 to 1 lead-to-cobalt ratio has been found to be very effective and a good starting point is 0.5 percent lead. Drying rates may be varied over a wide range by changing the percentage of lead without detriment to durability.

THERMALLY STABLE: **Chlorinated Hydrocarbons**

Pennsylvania Salt Mfg. Co., 1000 Widener Building, Philadelphia 7, Pa., is developing a series of new
(Continued)

Try an Amsco solvent for that "impossible" job

In many a plant today an Amsco solvent is being used to solve problems, that, at first, seemed almost impossible.

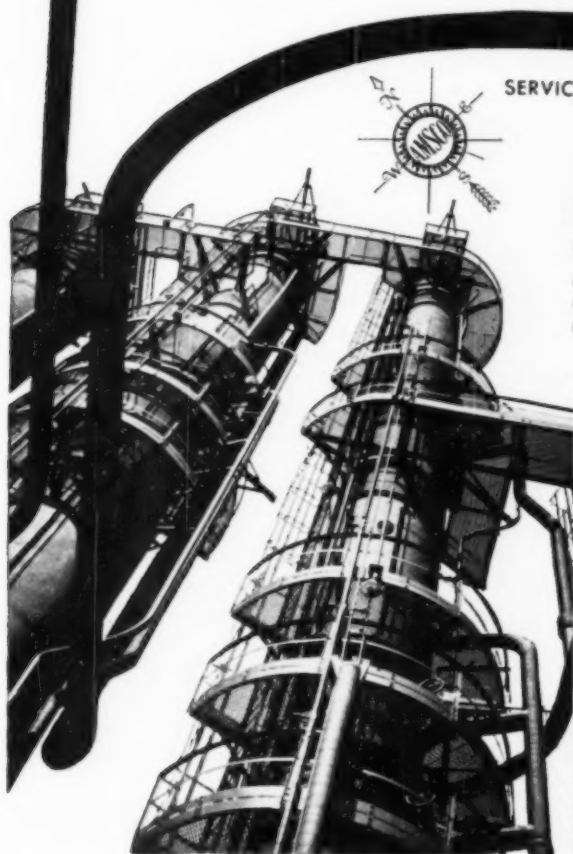
One reason for this is that our petroleum-base solvents are so extremely flexible and versatile. Add to this flexibility Amsco's quarter century of seasoned experience, and you can see why we welcome the chance to tackle knotty problems.

Amsco solvents are dependable . . . efficient . . . economical. They cost no more than less time-tested materials and you get:

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Amsco offers the most complete line of petroleum-base solvents available. And deliveries can be made promptly anywhere in the U.S.A.

Why not find out what these versatile solvents can do for your business. For full details . . . and with no obligation whatever . . . mail the coupon today!



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Bring your laboratory and plant operating results into closer relationship by applying the same fundamental principle of screening to both.

With "END-SHAK" the sieves are given an ideally combined reciprocating and turning motion which causes the sample to spread uniformly over the sieve area eliminating jumping and bouncing of the particles. Operation is smooth and with all working parts submerged in oil, noise and wear are reduced to a minimum.

Write us for additional data on this efficient test shaker.

NOTE: We have a service now for re-covering Testing Sieve Frames at nominal cost. Don't throw away frames with worn cloth. Write us.



Newark Wire Cloth COMPANY

350 VERONA AVENUE

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NEW PRODUCTS, CONT.

chlorinated hydrocarbons. The first of the series to come out of the Pennsalt Laboratories is a clear, viscous resinoid, with good thermal stability and showing no hydrolysis after 16 hr. of contact with water at room temperature and also at 100 deg. C. The product is known as Chlorinated Hydrocarbon-70.

Chlorinated Hydrocarbon-70 has no flash point and no fire point. It is compatible with such resins as vinyl chloride, styrene and rosin. At room temperature it is completely soluble in most alcohols, ketones and hydrocarbons.

During its development the new product was subjected to a series of preliminary physiological tests. Direct skin contact for a period of five days had no adverse effects on 200 people tested by an impartial toxicological laboratory. When the same tests were repeated on the same subjects three weeks later, no induced sensitivity was evident.

To test the acute vapor toxicity of Chlorinated Hydrocarbon-70, animals were exposed to concentrated vapors evolved from the heated material for a period of 8 hr. No untoward reactions were detected, according to the same laboratory.

The new chlorinated hydrocarbons have properties which suggest their use in many industrial applications. Among these are: as a plasticizer; as a flame retardant; in the manufacture of adhesives; and in other formulations for the impregnation or coating of wood products, textiles and paper.

While Pennsalt explores further possible applications, the product is being offered to industry for evaluation. Samples and data are available free of charge.

NON-TOXIC:

Sodium Trifluoroacetate

Hooker Electrochemical Co., Niagara Falls, N. Y., is now carrying out pilot-plant production of sodium trifluoroacetate. The compound is in the form of a white, odorless, non-corrosive, free-flowing powder.

This salt has a molecular weight of 136.02, and it is 98 to 99 percent pure. Very soluble in water, it is also soluble in ethanol, methanol, and methyl ethyl ketone. Sodium trifluoroacetate is slightly soluble in ether, and insoluble in benzene, carbon tetrachloride and perchlorethylene. Substantially an anhydrous material, the salt will pick up moisture if exposed to the air at room temperature. When heated to about 300 deg. C., it decomposes, the decomposition products reportedly

(Continued)

2
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SINGLE-UNIT
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ACID PLANTS...

With the acquisition of Standard Wholesale Acid and Phosphate Works, and Southern Acid & Sulphur Company, Inc., Mathieson now operates the *two largest single-unit sulphuric acid plants in the world*... adds another basic product to its growing list of industrial chemicals.

With other strategically located producing units, these plants form a network of supply centers which enables Mathieson to provide an even greater service to the chemical consuming industries. Mathieson Chemical Corporation, 60 East 42nd Street, New York 17, N. Y.

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CHEMICALS

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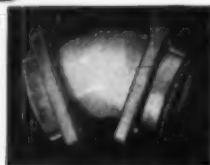
When it comes to
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Porcelain's inherent corrosive-resistant qualities make it impervious to electrolytic action. Therefore it is outstanding as a successful handling medium for chemicals. Specify Illinois porcelain for permanent systems, thereby eliminating frequent replacements of corroded parts.

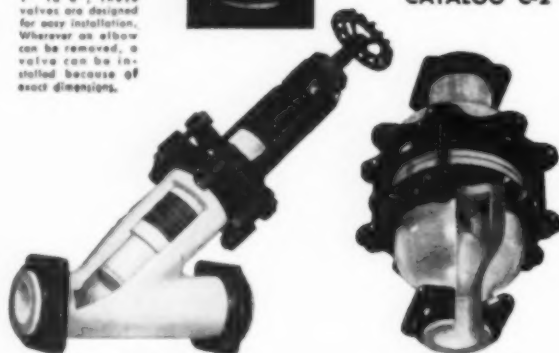


ANGLE VALVES
Available in all standard sizes from 1" to 6", these valves are designed for easy installation. Wherever an elbow can be removed, a valve can be installed because of exact dimensions.



PIPE AND FITTINGS
The inside and outside of all porcelain pipe and fittings are glazed white. The ends are ground true and smooth for gasket mounting. Flanges are accurately jig-assembled. Necessary bolts and nuts to make all connections are furnished for every joint.

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FOR
CATALOG C-2**



Y-VALVES

Each Illinois valve has a very carefully ground and lapped valve seat which will hold chemicals at high pressures. Every valve is routinely tested at 100 pounds pressure for a minimum of one hour to assure a perfect valve seat. Note that valve seat is located in lowest possible position to insure uninterrupted flow of material when stem is in open position. Packing is acid-resisting asbestos — graphite impregnated.

CHECK VALVES

Both vertical and angle check valves are porcelain to porcelain with no metal in contact with material being handled. Friction loss extremely low because ample space provided for flow around ball. Valve seat ground and polished to very close tolerances — ball is a polished sphere.



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MADE IN ILLINOIS

NEW PRODUCTS, cont. . .

including CO, CO₂, trifluoroacetyl fluoride and trifluoroacetic anhydride. The salt is resistant to hydrolysis, not being attacked by aqueous alkali at the boiling point. When converted to the acid, as is generally done for chemical processing, the acid is highly ionized.

Hooker sodium trifluoroacetate is non-toxic. Monofluoroacetates, however, are extremely toxic and difluoroacetates are fairly so. The salt is believed to be free of these dangerous impurities, but suitable handling precautions should be observed.

Physical and chemical properties of sodium trifluoroacetate suggest the possibility of its use as an intermediate in the preparation of herbicides, insecticides, and dyestuffs, and also as a condensing agent.

Technical Data Sheet No. 377, describing the salt, is available from Hooker upon request.

COPPERIZED:

Chemical Wood Preservative

Koppers Co., Inc., Pittsburgh 19, Pa., and E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del., as a result of their joint research program, have come up with a new chemical wood preservative. It is Copperized Chromated Zinc Chloride.

Tests have revealed that Copperized CZC possesses greater permanence of its toxic constituents than CZC and that the metal corrosion factor and the glow characteristics of the two preservatives are about the same.

The new preservative, containing 73 percent zinc chloride, 20 percent sodium bichromate and 7 percent cupric chloride, has proved in pilot-plant treatments to be similar in handling, treating, and control of the solution equilibrium to Chromated Zinc Chloride and other salt preservatives containing more than one type of toxic ion.

Development of this new preservative is another result of the cooperative research program conducted for many years by Koppers and Du Pont.

MODIFIED:

Drying Oils

Spencer Kellogg & Sons, Inc., Buffalo 5, N. Y., announces that, as a result of extensive research on reacting linseed and soybean oils with dicyclopentadiene, new oils are now available on a commercial scale. It is believed that dicyclopentadiene is depolymerized by heat and that the monomer reacts with the double bonds of the

(Continued)



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TO FINGER PAINTS



*Nothing takes the place
of Glycerine*

Each year, millions of pounds of glycerine flow into the manufacture of the staples of the coating industry: the alkyds . . . the ester gums. And each year, in hundreds of new applications over a wide range of products (finger paint is just one), glycerine demonstrates again and again its unparalleled versatility.

A trihydric alcohol, glycerine lends itself to numerous syntheses because of the easily controllable reactivity of its OH groups. Glycerine-based resins are readily manufactured with a minimum of variation from batch to batch.

Also, glycerine is a plasticizer . . . a humectant . . . a solvent. It resists oil and grease. It's immiscible with hydrocarbon solvents. It's an anti-freeze. Its combination of physical and chemical properties can be matched by no other product.

That's why for dependable performance in the coatings industry—or in almost any industry—*Nothing takes the place of glycerine!*

GLYCERINE PRODUCERS' ASSOCIATION

295 Madison Avenue
NEW YORK 17, N. Y.

Technical GLYCERINE NEWS

A CORROSION-RESISTANT COATING FROM CASHEW NUTS is said to produce a bond with iron, steel, and other metals so strong that it is practically impossible to separate. Secret of the unusually strong bond is a sublayer paint made from an alkyd resin, an important end-product of glycerine. (R-6)

★ ★ ★

NEW WATER-REMOVABLE PAINTS, described as glycerine-plasticized gluten dispersions, are said to be useful as temporary masks to keep sprayed paint off selected areas. (R-7)

★ ★ ★

WHY ALKYDS IN PRINTING INKS? A comprehensive report, published recently, in a leading periodical, discusses the reasons for the growing importance of alkyd resins in printing inks. Chief reason, given by the authors, is the improved properties—such as faster drying, greater scratch-resistance, and better "hold-out"—imparted to the inks by the alkyds. (R-8)

★ ★ ★

TABLE OF GLYCEROL VISCOSITIES NOW AVAILABLE. The research laboratories of the Glycerine Producers' Association have prepared a table of viscosities of glycerol in aqueous solution from 0 to 100 per cent, at from 0 to 100 degrees C. Copies may be obtained by checking item (R-9) on the coupon below.

★ ★ ★

AN IMPROVED ANTI-ICE PAINT for preventing ice formation and accumulation on various surfaces including aircraft propellers is said to be prepared by reacting glycerine and phthalic anhydride. It can be applied by spraying or brushing, the maker states. (R-10)

GLYCERINE PRODUCERS' ASSOCIATION, DEPT. 4
295 MADISON AVENUE
NEW YORK 17, N. Y.

I should like to know the source of those items appearing in Technical Glycerine News which I have checked below.

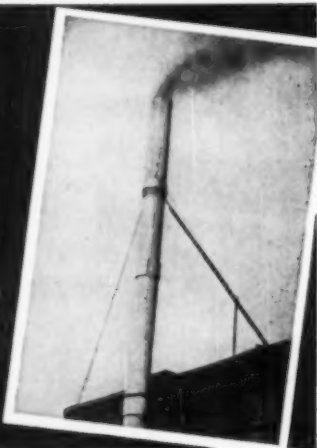
☐ R-6 ☐ R-7 ☐ R-8 ☐ R-9 ☐ R-10

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...for Transite Industrial Vent Pipe

Neither sun, nor rain, nor snow... nor the usual run of corrosive fumes, vapors, dusts and gases present a problem with Transite® Industrial Vent Pipe on the job.

That's because this Johns-Manville asbestos-cement product cannot rust... has the ability to stand up against many corrosive agencies. Thus, it helps avoid costly replacements... helps effect reductions in plant maintenance costs.

Adaptable to many venting jobs—Transite Industrial Vent Pipe may be used for vents, ducts or stacks. Its wide range of sizes (up to 36" diameter) adapt it to practically any job requirement. And a complete line of Transite fittings insures corrosion resistance throughout the venting system.

Easily installed—This pipe presents no installation problems. Light

in weight, it is readily handled—and can be cut and drilled on the job with ordinary tools. Yet its durable asbestos-cement composition assures long-term, dependable service—an advantage proved in numerous industrial venting installations.



Where venting systems run through the roof, Transite Ventilators provide the same corrosion resistance service as Transite Industrial Vent Pipe.

For additional information about Transite Industrial Vent Pipe, write for Data Sheet, Series DS-336. Address Johns-Manville, Box 290, New York 16, N. Y.



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Typical industries in which Transite Industrial Vent Pipe is used:

Aircraft	Dairy	Gas	Petroleum	Shipbuilding
Automobile	Drug	Glass	Potash	Shoe
Baking	Electrical	Laboratory	Pulp & Paper	Smelting
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Boiler Works	Farm Machinery	Leather	Railroad	Soft Drink
Brewing	Food	Meat Packing	Rayon	Sugar Refining
Canning	Foundry	Metal	Refrigeration	Textile
Ceramic	Furnace	Mining	Rubber	Tool
Chemical	Furniture	Paint	Sewage Works	Water Works

Johns-Manville TRANSITE Industrial Vent PIPE

New Products, cont. . .

oil in accordance with the Diels-Alder reaction. The linseed base oil will be known as Cykelin and the soybean base as Cykelsoy.

Cykelin will be produced with a Gardner-Holdt viscosity of Z2; it has a pale amber color and a low acid number. It sets in a few hours and dries extremely hard overnight. Water and alkali resistance of the films are excellent. Cykelin is completely miscible with bodied or unbodied oils. The oil is specifically recommended for varnishes, enamel vehicles, and as a general reinforcing oil where advantage can be taken of its fast through-dry and excellent film hardness.

Chemistry of Cykelsoy is similar to that of Cykelin, except that soybean oil is used as the base. Also produced in a Z2 viscosity, Cykelsoy has a somewhat darker color. Cykelsoy sets slower than Cykelin but dries very hard overnight; its water and alkali resistance are good. Cykelsoy is also recommended for use in varnishes and enamel vehicles.

Both oils are supplied at 100 percent solids and are now available to the protective coatings industry in commercial quantities.

FOR RESEARCH: Fluorocarbon Gas

Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul 6, Minn., is now offering for sale in research quantities a new fluorocarbon gas. The compound is C_2F_6 , a colorless, odorless, non-toxic gas which boils at -36 deg. F. It is stable and unreactive under conditions of high pressure and high temperature.

Possible applications include use as a refrigerant gas, gaseous dielectric, fire retardant and insecticide impellent.

The new fluorocarbon gas is made in the 3M company's pilot plant in St. Paul, using the electrochemical process developed by Dr. J. H. Simons of Pennsylvania State College. Price of the compound is \$4 per lb. This new fluorocarbon gas is being offered for application testing only. It is not available in large commercial quantities.

Also available are research-size samples of the few related fluorocarbon gases now being made by Minnesota Mining, with boiling points from -200 deg. F. to 28 deg. F. Among them are CF_4 and C_2F_4 .

Samples and detailed technical data are available from the New Products Division of Minnesota Mining in St. Paul.

—End

SUPERHEATERS

FOR

STEAM

AIR

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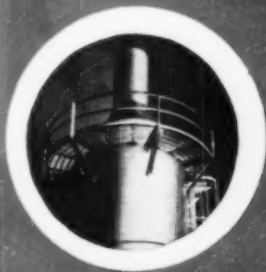
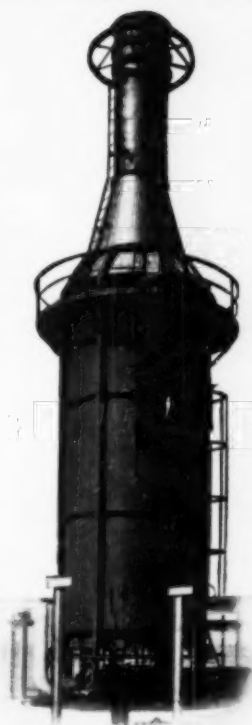
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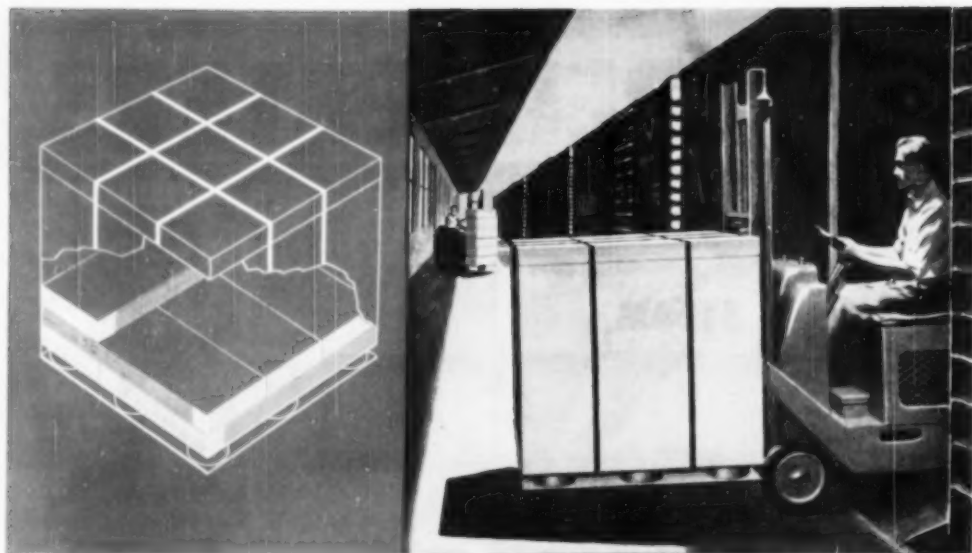
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ONE of the hidden costs in packaging is in the handling of packaging materials from unloading dock to warehouse to packaging assembly line.

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Handling, Packaging and Shipping

R. W. LAHEY, Editorial Consultant

ICC Amends Regulations for Transportation of Dangerous Articles

Amendments to the ICC Regulations for the Transportation of Explosives and other Dangerous Articles that were published in March were mandatory after June 4.

The order revises the paragraph numbering system to comply with the Code of Federal Regulations. Those changes of interest to the chemical industry are summarized as follows:

1. Sec.64(c)(13)(b)(1) Railroad Torpedoes. Spec. 23F fiberboard boxes, maximum gross weight packed container 65 lb. have been added to the approved list of containers.

2. Sec.108g and 109f Ethyl Chloride and Ethylene Chloride. Spec. 104AW, 105A300, 105A300W, 105A400, 105A400W, 105A500, 105A500W, 105A600, and 105A600W tank cars have been added to the approved list of tank cars for shipping these compounds.

3. Sec.110(a)(3) and 110(a)(13) Flammable Liquids Flashing Below 20°F. Spec. 5M Monel metal drums have been approved as containers for shipping these liquids. To the approved list of tank cars the following have been added—Spec. 103-W, 104-W, 104A-W, 105A300, 105A300-W, 105A400, 105A400-W, 105A500, 105A500-W, 105A600, 105A600-W.

4. Sec.110(c)(5) Flammable Liquids With Vapor Pressures Exceeding 16 psi. and not Exceeding 27 psi. at 100°F. The following tank cars have been added to the approved list: Spec. 103-W, 104-W, 104A-W, 105A300, 105A300-W, 105A400, 105A400-W, 105A500, 105A500-W, 105A600, 105A600-W.

5. Sec.110(c)(8) Flammable Liquids With Vapor Pressures Exceeding 27 lb. and not Exceeding 40 psi. at 100°F. The following tank cars have been approved for shipping these compounds: Spec.104A-W, 105A300, 105A300-W, 105A400, 105A400-W, 105A500, 105A500-W, 105A600, 105A600-W.

6. Sec.156(a), (b) & (f) Calcium Peroxide has been included in the list of flammable solids and must be packed as specified for barium peroxide. The quantity of both compounds

that may be packed in inside glass containers has been increased from 1 to 5 lb. To the approved list of outer containers, consisting of Spec.15A, 15B, 15C, 16A & 19A wooden boxes, fiber drums Spec.21A has been added.

7. Sec.163(c) (note 2) Chlorate of Soda, Chlorate of Potash and other Chlorates. Spec.37E and 37F metal drums marked for authorized gross weights of not over 160 lb. must be fabricated of not less than 24 ga. sheets when used for export shipments.

8. Sec.204(d)(e) Sodium Hydrosulphite. Spec.37K metal drums have been added to the approved list of single trip containers. Spec.37D, 37E, and 37F single trip metal drums may no longer be used for water shipments. Fiber drums Spec.21A net weight not over 250 lb. have been approved for other than water shipments. These containers have a special laminated metal foil ply in the sidewalls. Metal

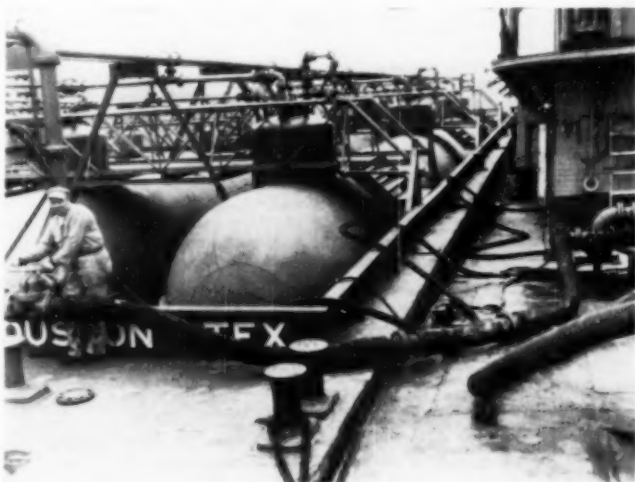
foil barrier is also required in heads. Exteriors must contain a water resistant coating. In addition to tests prescribed by specification, drums must be given a 4 ft. diagonal bottom chime drop and after emptying must withstand without leaking immersion of the bottom in 6 in. of water for 4 hr.

9. Sec.253A b Chlorine Trifluoride. Spec. 3E1800 and 4B240 cylinders have been added to the approved list of cylinders.

10. Sec.261A f(1) & f(2) Formic Acid. Stainless steel metal drums Spec. 5G have been approved for packing formic acid.

11. Sec.278 Nitrohydrochloric Acid has been added to the list of corrosive liquids and the detailed packing instructions are as follows:

(a)(1) Nitrohydrochloric acid, which is a mixture of nitric acid not over 1.42 specific gravity and hydrochloric acid not over 1.19 specific gravity in the approximate proportions of one part nitric acid and three parts hydrochloric acid, must be packed in (Continued)



BARGE TAKES HCl FROM TEXAS TO OHIO.

One of four barges used by Dow Chemical Co. to transport hydrochloric acid from Freeport, Tex., to Cincinnati, Ohio, a distance of approximately 1,850 miles. A barge carries 6 tanks of 36,000 gal. capacity each. Tanks are rubber lined with Goodyear's Ploweld. It requires about a month for a barge to make the round trip.

HOW TO KEEP THINGS STIRRED UP



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Industrial mixers by Eastern keep things stirred up in food, chemical and petroleum processing industries—whether it's blending or mixing you're after. Every Eastern mixer is factory pre-tested for performance. Every Eastern mixer is guaranteed to give you long, economical service.



MODEL H-1

A heavy duty $\frac{1}{4}$ H.P. High speed service; 1725 R.P.M. Shaft length, 30". Dual low pitch props, 4" in diameter. Semi-enclosed, totally enclosed or explosion-proof motors available. Screw clamp or bracket mounting.

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PACKAGING, cont. . .

specification containers as follows:

(a)(2) Spec.15A, 15B, 15C, 16A or 19A.—Wooden boxes with glass inside containers of not over 5 pints capacity each, individually inclosed in tightly closed metal cans and cushioned therein with sufficient incombustible mineral material.

(b)(1) Nitrohydrochloric acid diluted, is a solution of nitrohydrochloric acid as described in (a)(1) which has been diluted to not less than five times the volume of water and must be packed in specification containers as follows:

(b)(2) Spec.15A, 15B, 15C, 16A, or 19A.—Wooden boxes with glass inside containers of not over 5 pints capacity each, individually inclosed in tightly closed metal cans and cushioned therein with sufficient incombustible mineral material.

(b)(3) Spec.1A or 1D.—Carboys, glass, boxed, capacity not over 5 gal. for Spec.1A, and 6.5 gal. for Spec.1D.

12. Sec.303(k) Cyclopropane has been added to the list of compressed gases and may be shipped when packed to a maximum filling density of 55 percent in specifications 3A225, 3B225, 4A225, 4B225, 4BA225, 7-300, 3, and 3E1800 cylinders.

13. Sec.303 Several minor changes have been made in the regulations pertaining to packing and shipping of compressed gases in cylinders.

14. Sec.323A. Nitrogen Dioxide Liquid (nitrogen peroxide, tetroxide). Spec.106A500 tank cars have been approved for shipping these Class A poison gases. Gas protection caps are required and must be approved by the Bureau of Explosives.

15. Sec.368f. Radioactive Materials. Fiber drums Spec.21A have been added to the approved list of shipping containers.

16. Sec.368J. Radioactive Material Group III. This group of compounds formerly limited to liquids and solids, has been extended to include "gaseous" products.

17. Compressed Gas Cylinder Specifications. Many changes in the details of construction and testing have been made in these specifications. Paragraph references to these amendments are as follows: Spec. 3AA, par. 5; Spec. 4B, par. 8(b), 23(h); Spec. 4BA, par. 5, 8(b)(1), 16(b)(1), 19; Spec. 8, par. 22(a), 22(f), and 22(f)(3).

18. Spec.5M. Monel Metal Drums. The maximum capacity of these drums has been increased from 10 to 55 gal.

19. Spec.37K. Steel Drums. This new specification has been adopted for removable head drums to be used for packing sodium hydrosulphite.

The order should be consulted for the complete details.

Exterior Protection For Tank Cars

Specification ICC-103B tank cars used for transporting muriatic acid and other corrosives are often subject to rapid corrosion in the area around the domes. To overcome this, members of the MCA tank car committee have been experimenting with synthetic rubber, and chlorinated rubber coatings. These tests have also been extended to the protection of domes of caustic soda, sulphuric acid and ferric chloride tank cars. According to reports, excellent results have been obtained with these coatings after 10 months of trial.

Enforcement Provisions

House of Representatives Bill 3940 introduced on March 31 provides enforcement provisions for regulations for transportation of explosives and other dangerous articles by air. This bill when passed will amend the Civil Aeronautics Act of 1938 formalizing the recently publicized regulations of the Civil Aeronautics Board.

Saran Linings for HCl Tank Cars

Tests of Saran rubber lined tank cars in muriatic acid service, conducted by the MCA tank car committee have been so successful that it is expected application will soon be filed for approval for use in transportation of tank cars lined with this compound.

It is reported that Saran rubber bonds well to steel and it is applied and vulcanized by the same processes used for natural rubber.

MCA Committee Meetings

Spring meetings of the technical committees of the Manufacturing Chemists Association were held early in April at Youngstown, Ohio.

Following their regular custom, one day was devoted to plant trips. Members visited the Sharon plant of the United States Steel Products Co. and to the two plants of Niles Steel Products Division of Republic Steel Corp. in Niles, Ohio. Committee members witnessed first hand the fabrication of several types of steel drums and pails as well as the welding of stainless steel containers. Interest was displayed in the lining of interiors of these containers.

For some time, the Metal Packages Committee has been active in the development of a 15 gal. stainless steel container for nitric acid that might be used as a substitute for glass carboys. It was announced that a bilged con-

(Continued)

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Secondary Butyl Acetate— $\text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}_3$
Isopropyl Ether— $\text{C}_3\text{H}_7\text{OC}_3\text{H}_7$
Methyl Ethyl Ketone— $\text{CH}_3\text{COC}_2\text{H}_5$

ENJAY HYDROCARBONS

Butadiene— $\text{CH}_2=\text{CHCH}=\text{CH}_2$
Isobutylene— $\text{CH}_2=\text{C}(\text{CH}_3)_2$
Diisobutylene— $\text{CH}_2=\text{C}(\text{CH}_3)\text{CH}_2\text{C}(\text{CH}_3)_2$ †
Triisobutylene— $\text{CH}_2=\text{C}(\text{CH}_3)\text{CH}_2\text{C}(\text{CH}_3)_2\text{CH}_2\text{C}(\text{CH}_3)_2$ †
† Other isomers also present.

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For high temperatures (up to 2400° F) or low (down to -200° F), there are "48" blocks, cements, felts, blankets and loose wool to handle every insulating job effectively. Write for your copy of the "48" Industrial Insulations Catalog today... And remember the high cost of small cracks next time you inspect your furnace and equipment insulation.

* Calculated for $\frac{1}{4}$ " x 2' crack; hot wall to cold wall temperature differential, 850° F.—giving 5500 B.t.u. lost/hr.; coal: 10,000 B.t.u./lb.

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PACKAGING, CONT. . .

tainer somewhat similar to the half barrel for beer has been designed and is ready for field evaluation. This all welded container made of Type 304 stainless has an opening in one head and is designed for easy handling.

As a result of failures in export service of sulphuric acid drums Spec.17F, this committee has developed a venting bung that prevents build up of pressure in these containers. The plug contains a carbon disk around which the metal is cast. After exhaustive plant tests, several hundred 55-gal. drums have been manufactured.

New Cars for LCL

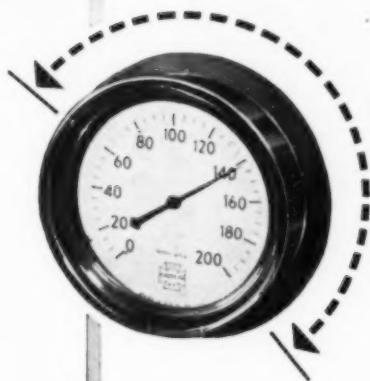
A study by the Pennsylvania railroad of transportation damage to LCL traffic has led them to place in service a new type box car. Some of these cars designed to reduce damage from end-to-end shifting and crushing in lower tiers are 60 ft. long—capacity of 50 tons. Upper and lower sectional steel gates are fastened to the sides of the car approximately 6 ft. apart. When closed together they lock together to form bulkheads across the car from the floor to near the ceiling. After a section of the car is loaded to the top of the lower compartment, the lower gates are locked in position and the shelves are swung up and made to rest on the top of the adjacent gates, forming a second floor or deck between the car floor and ceiling.

Now in service are 100 60-ft. cars and 300 50-ft. cars equipped with these swinging gates and shelves. Many other railroads are also working on the development of similar methods to reduce damage in their freight cars. It is believed that some similar type of within-car bracing may eventually become standard equipment on most progressive railroads.

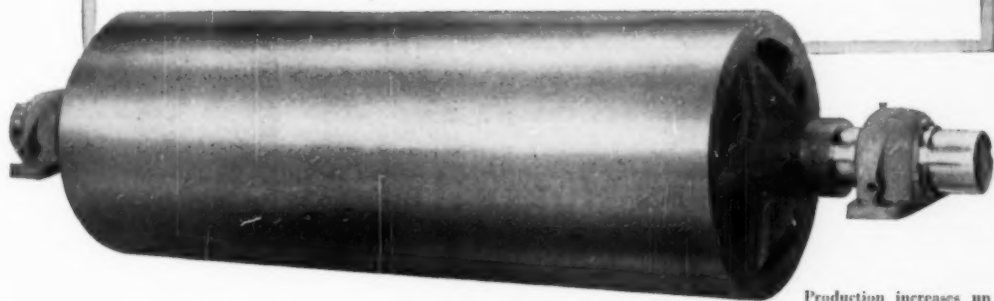
Corrosion Inhibitor

Developed by Shell Development Co., an organic chemical compound coated on paper provides a corrosion resistant wrap for metal parts. This chemical vaporizes slowly and the vapor inhibits corrosion. Paper converters are licensed by Shell to apply the coating, called "VPI," to wrapping papers.

This new method does not depend on exclusion of oxygen and water vapor from contact with the metal. The vapors actually inhibit rusting from condensed or absorbed moisture. The low volatility of the compound requires only a wax coating or asphalt liniment to retain the vapors in sufficient concentration around the packaged metal. —End



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ROGER WILLIAMS, JR., Assistant Editor



Chairman Davis tells Reporter Gambatese . . .

HOW MEDIATION PANEL WILL FUNCTION

The Panel—Three impartial members, headed by William H. Davis. The panel is permanent, but its members will serve only when needed and get paid only for actual days worked.

Jurisdiction—It may step into any dispute where bargaining and normal conciliation have failed which threatens to interfere with an essential part of the atomic energy program.

Mediation—The panel is given a free hand in trying to bring about an agreement. If the labor contract contains procedures for settling some issues without strike or lockout, then the panel will return those issues to the parties for settlement under the contract procedure.

Arbitration—The panel will encourage use of voluntary arbitration, with agreed limits on the arbitrator's authority. It will reserve the right to act as arbitrator if both sides desire it, but Davis thinks that, normally, persons outside the panel should decide atomic disputes which both sides submit to arbitration.

Recommendations—If the panel is unable to bring about a voluntary agreement, it may in its discretion recommend the terms of a settlement. It does not have to make recommendations. The panel will be free to "make whatever suggestions and take whatever steps may seem appropriate at the particular time in view of the particular situation."

Status Quo—Contractors operating government-owned installations and recognized unions must agree that production or services will not be interrupted, and wages and working conditions will not be changed except by agreement, until 30 days after the panel makes recommendations.

Exceptions—This does not apply (1) if the panel does not take jurisdiction within 15 days after either side asks it to do so; (2) if, at least 30 days after jurisdiction is taken, either side gives notice of a desire to terminate its obligation and the panel fails to make recommendations within 20 days thereafter, or (3) whenever the panel announces that it does not intend to take, or is terminating, jurisdiction.

New Machinery Set Up to Handle Atomic Labor Troubles

JOSEPH M. GAMBATESE

If we get another strike threat at Oak Ridge this year, it will be handled differently. The Atomic Energy Commission has set up an Atomic Energy Labor Relations Panel to step in, as a last resort, and try to settle all labor disputes which threaten to interrupt production or services vital to our atomic energy program.

Last year the Taft-Hartley 80-day national emergency injunction was invoked to block a strike voted by the AFL Atomic Trades Council at the National Laboratory operated for AEC by Carbide & Carbon Chemicals Corp. The 80 days went by without a settlement. The workers did not strike.

Mr. Gambatese is a member of McGraw-Hill's Washington News Bureau. He is a specialist in labor relations.

A few days later the union and the company came to an agreement.

The new atomic labor panel is the outgrowth of that strike threat. The signatures on the new labor contract were hardly dry when President Truman on June 18 made a report to Congress as he is required to do under the Taft-Hartley law at the expiration of an 80-day injunction. He reviewed what happened and said he was appointing a commission to study the problem of settling labor disputes in atomic plants owned by the government but operated by private contractors.

The commission was named in September: William H. Davis, former head of the National War Labor Board, chairman; Edwin E. Witte, head of the U. of Wisconsin economics department, and former NWLB member, and Aaron Horvitz of New York, prominent arbitrator.

Its report, released in mid-April, was well timed. It gave Truman a chance to get set for important negotiations coming to a head this month at the laboratory and gaseous diffusion plant run by Carbide and Carbon at Oak Ridge and at the new plutonium plant run by General Electric at Richland, Wash. It also offered a chance to try to kill one of the arguments for continuing the 80-day injunction when Congress went to work on the Taft-Hartley law. Truman praised the report, referred the recommendations to AEC. AEC approved. Truman then set up the panel and named Davis himself as chairman and one of the three members.

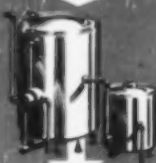
Anyone who knows Davis was not surprised by what his commission recommended. He would not outlaw strikes or lockouts. Nor would he urge compulsory arbitration. Injunction? Not a chance.

What was left, then, was a technique that worked on the railroads for 20 years until the 1946 strike—a series of delaying steps from collective bargaining through mediation to
(Continued)

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MM&M, cont. . .

recommendations by a special board. During this period, both sides would be pledged not to strike or lockout. Since 1946 however, the Railway Labor Act has had such rough going that even the National Mediation Board which administers it has suggested the idea of possible revision.

What the Davis Commission recommended and AEC adopted, is a sort of Railway Labor Act for the atomic energy industry. There is this important difference: The Taft-Hartley Act still applies, and its successor also will apply to atomic production.

In other words, the atomic labor panel has been sandwiched in as another agent in trying to settle a vital atomic labor dispute without interruption of work.

Presumably, if the 50-day injunction is retained in the federal labor law, it can still be invoked if the atomic labor panel does not settle a dispute.

Davis knows he doesn't have a sure-fire answer to the problem of maintaining continuity of vital atomic production while, at the same time, protecting the public interest and the rights of management and workers. But he figures it's worth a try for two or three years. If it doesn't work, it can be dropped before that at AEC's pleasure. Experience might dictate what legislation may be necessary, if any. Right now, Davis—and AEC—see no need for new law.

HISTORY OF THE PLAN

The plan for handling atomic labor disputes did not develop in a vacuum. AEC reviewed the history of its labor policy and some of the problems involved in a report submitted Jan. 16, 1948, to the Joint Congressional Committee on Atomic Energy. The joint committee held hearings on the subject the following March. Witnesses included AEC Chairman David E. Lilienthal, U. S. Conciliation Chief Cyrus S. Ching, AFL Metal Trades Leader James A. Brownlow, Benjamin C. Sigal, counsel for the CIO Gas, Coke, and Chemical Workers, and Silas W. Pickering II, director of industrial relations for Carbide & Carbon Chemicals Corp.

These witnesses were pretty much in agreement on these major points: (1) Private operation of the atomic facilities under government contract should be continued. (2) Contractors and unions have a moral responsibility not to interrupt vital atomic production. (3) Loyalty of atomic workers is essential. (4) Compulsory arbitration is undesirable. (5) The legal right to strike or lockout should not be taken away. (6) There should be

(Continued)

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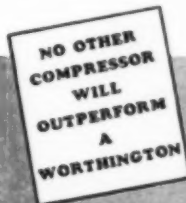
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Y-Types



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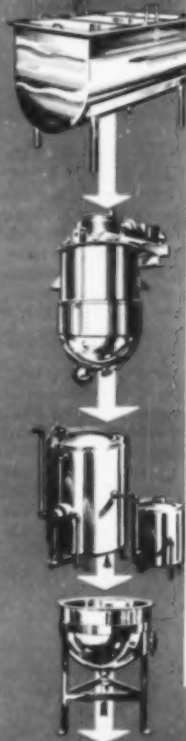
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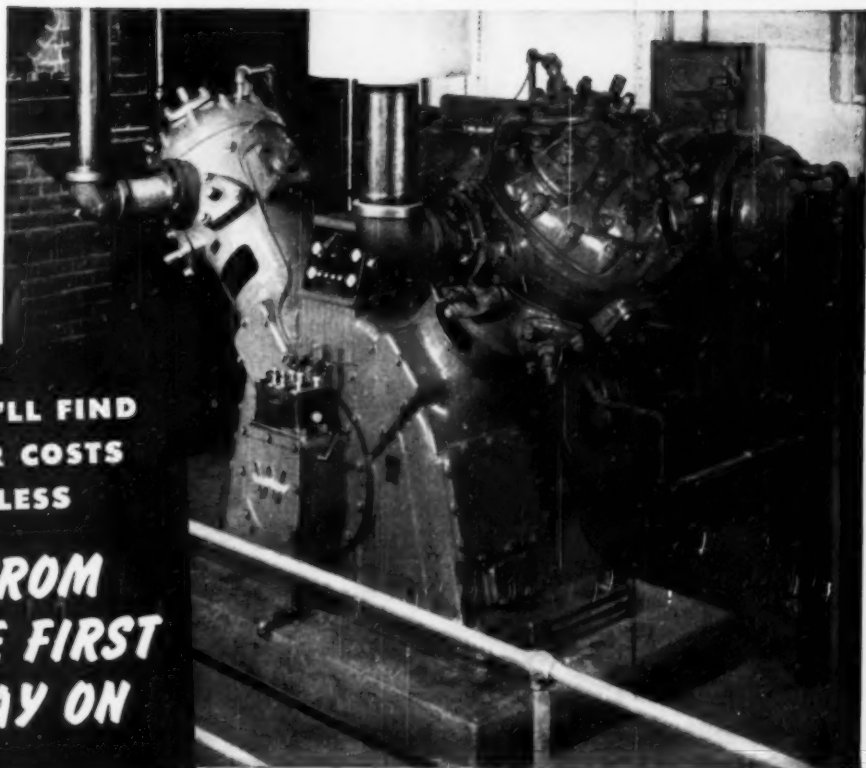
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a minimum of interference with the management of the facility or with the rights of the employees. (7) The government should keep out of atomic labor disputes as much as possible.

The 350 prime AEC contractors and unions representing their 63,000 employees are being asked to agree that production or services will not be interrupted until the machinery for settling vital atomic labor disputes has run its course.

AEC is given final authority on all questions of security. Neither the security rules or their administration will be subjected to bargaining. This backs up AEC's policy of requiring non-Communist affidavits from union leaders and others influential in negotiations and union policies. AEC's order barring General Electric from bargaining with the left-wing CIO electrical worker's union was upheld by a Federal District Court which dismissed the union's \$1-million suit against AEC and GE. The court held that AEC acted within its powers under the Atomic Energy Act.

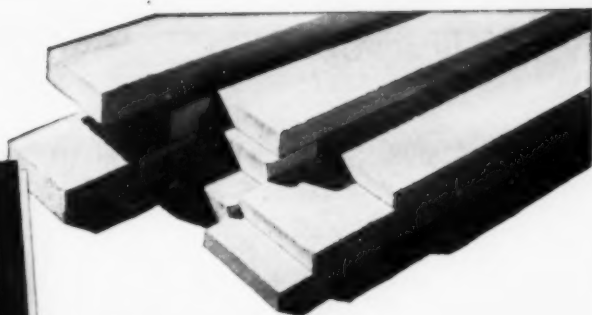
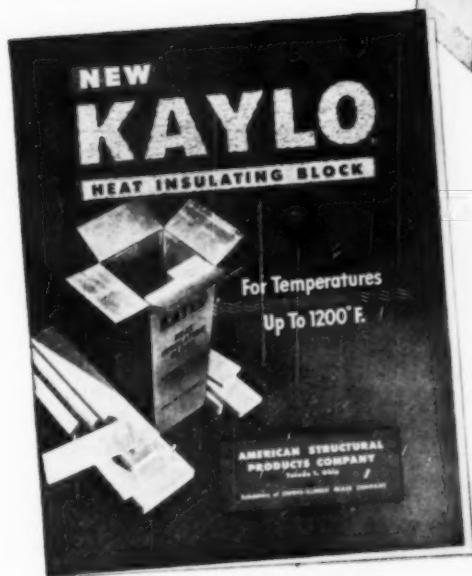
Wages, hours, and working conditions are left to free collective bargaining insofar as they are in line with those of comparable industry in the same area. AEC is drafting (as we write) an interim statement of policy on labor cost items. It will serve as a guide to contractors as to how far they can go and rest assured that they will get AEC approval of new labor costs. The policy is to be discussed with contractors and unions before it is made permanent.

The purpose of this is to facilitate bargaining and give contractors more freedom in making settlements without first running to "papa" to find out if Uncle Sam will pay the bill. (AEC contracts are all cost-plus-fixed-fee, and added costs must get AEC approval.) It will be something like the wartime wage stabilization, when employers could make certain upward adjustment in wages and grant other "fringe" concessions without getting WLB's approval.

All labor contracts of AEC contractors must contain a grievance machinery for settling disputes over interpretation or application of the contract, with arbitration as the final step unless the parties can agree on some other method which will assure that there will be no stoppages during the life of the contract.

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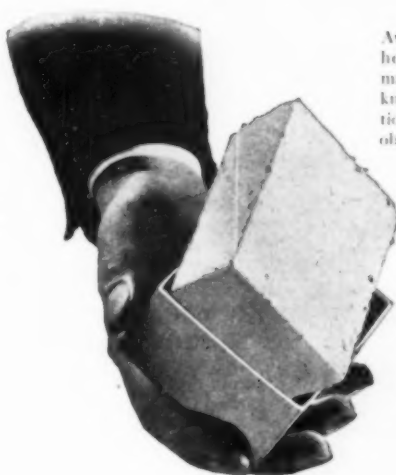


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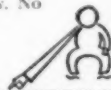
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MM&M, cont. . .

ficers are urged to bring their experience and influence to bear in settling disputes.

It is also suggested that AEC contractors do not fight union efforts to get recognition through the National Labor Relations Board. Contractors are asked that they agree to consent elections when elections are ordered by NLRB and that they do not make an issue of what the proper bargaining unit should be.

When unions become established as the employees' bargaining agent at an atomic installation, contractors are asked to cooperate with the unions to integrate them in the plant organization "as a two-way channel to communication and a medium of understanding between management and workers."

BARGAINING LIMIT

There is a limit to how far free collective bargaining can be carried and still require continuity of production. At some point, if disagreement is prolonged, somebody must make a decision. Neither the contractors nor the unions wanted compulsory arbitration. The new plan goes just short of that. It gives the panel the authority to make recommendations for settling the unresolved dispute.

Although either side may reject the recommendations and strike or lock out after "cooling off" for 30 days (unless some law, such as Taft-Hartley, is invoked), the real fact is that the force of public opinion behind the recommendations will likely give them the color or status of a binding arbitrator's award.

There is this possible difference: During the 30 days after the recommendations are issued, the parties might negotiate further on the basis of the recommendations and agree on some alternative settlement.

It is the panel's intention not to inject itself in a dispute until all normal procedures have failed—collective bargaining, use of the Federal Mediation and Conciliation Service and, where applicable, machinery in the labor contract.

Nor will it take on all atomic labor disputes. The panel will limit its interest to those which are vital to the continuous production of atomic bombs.

This is necessary if the panel is not to interfere with normal bargaining. Otherwise, either side of a labor dispute might try to short-circuit bargaining to get before the panel. A lot of that happened during the war when the War Labor Board stood ready to decide disputes—and one of the

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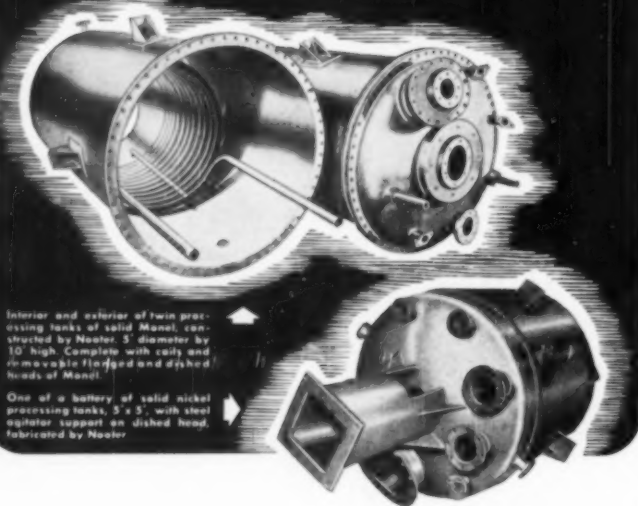


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MM&M, cont. . .

parties thought he could get a better deal from the board.

In other words, it's anticipated that many atomic labor disputes will be allowed to take their normal course—even to the point of a strike. They are the disputes in which a strike will not hamper the actual production of bombs. Most of these are in construction or maintenance.

As this is written, strikes of laborers and engineers at Los Alamos, N. M., and electricians at the Hanford plant in Richland, Wash., have been in progress for many days. Electricians struck last summer at Oak Ridge. They caused little excitement.

Significantly, the panel's activities are not specifically confined to disputes in government-owned privately-operated atomic energy installations.

The panel is empowered to take jurisdiction of any labor dispute "which threatens to interfere with an essential part of the atomic energy program."

This leaves the door open for the panel to intervene, if the situation warrants, in a dispute affecting any of the thousands of suppliers of AEC contractors. That is because, conceivably, the inability of a supplier to deliver a vital material might under some circumstances be a bigger threat to the atomic energy program than a strike against a prime AEC contractor.

This possibility was recognized by AEC in its labor policy statement to the joint congressional committee last year.

AEC pointed out that it tries to maintain a 60-day stockpile of critical materials. But some things, like electric power, cannot be stored in great quantities. Others, like some chemicals, cannot be stored for long periods without substantial loss.

As a starter, the AEC plan for handling atomic labor disputes has considerable merit. Its success will be determined largely by the good will of contractors and unions and the way they demonstrate their recognition of the great moral responsibility placed upon them.

Briefs . . .

Safety. Do you belong to the Wise Owl Club? We hope not. But if the occasion ever arises we hope you will become a member rather than lose an eye.

Chemicals. The new Chevrolet has 93 lb. of chemicals in it. Of that total, 55 lb. is glass and 21 lb. is paint. That means the amount of chemicals actually on the automobiles produced in 1948 was nearly 400,000,000 lb. —End

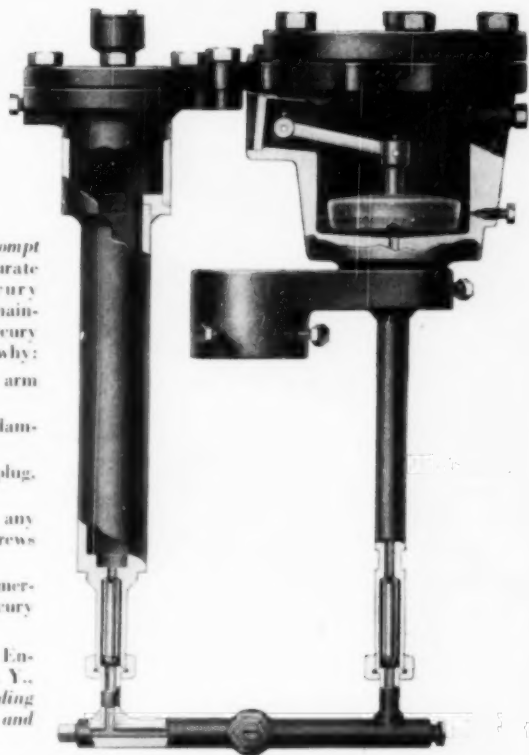


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- (c) *Easy to fill*—vent valves in cover, mercury level plug, built-in mercury funnel, bull's eye level.
- (d) *It's easy to fit* Manometer on pipe support in any position—and in accurate alignment—thanks to set screws instead of threads.
- (e) *And to change range* you simply: (1) Drain mercury. (2) Take out old range tube. (3) Fill with mercury to sight level. (4) Re-zero.

Write for Bulletin 98182, or ask your Taylor Field Engineer, Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada. Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.



QUICK FACTS FOR THE ENGINEER

1. **High Accuracy**—Inherent straight line calibration.
2. **Floating Power**—great power made possible by large float and long travel, transmitted by non-corroding "Teflon" bearing which "floats" power through to the pen.
3. **Positive Actuation**—High energy output. (a) **Big 3/4" float**. (b) **Long travel of float—1"**. (c) **Simple lever system**. Stainless steel lever arm fastened to flat of pressure-tight bearing shaft with screw. (d) **Teflon in pressure-tight bearing surfaces** assures efficient use of power because: Teflon bearing, micro-finished shaft, silicone lubricant give unprecedented performance—leakless, and negligible friction under high

working pressures. Union coupling on bearing housing prevents distortion of bearing and binding of shaft. (e) **Jewelled thrust bearing**.

4. **"Dependable Performance"** (a) **Submerged check valves**. (b) **Unique damping valve** easily adjusted under full pressure without leakage. (c) **Ample capacity** in mercury chambers to accommodate effects of surges or pulsating flows. (d) **Teflon holds pressure**, yet allows shaft to rotate freely and assure long, dependable service.

5. **"Great Adaptability"** (a) **Six interchangeable range tubes**: 10", 20", 50", 100", 200", and 400" of water. (b) **Tubes can be easily changed** in field without piping alterations.

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for Grinding...

Coarse...

Fine...

Wet...

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A *Traylor* MILL IS YOUR best buy

... because Traylor Grinding Mills reflect more than 45 years experience in building grinding equipment which is *profitably* used in many fields.

Traylor is continually designing and building mills of every type—ball, rod, ball-tube, pebble ... with one, two or three compartments—to do a particular job most efficiently.

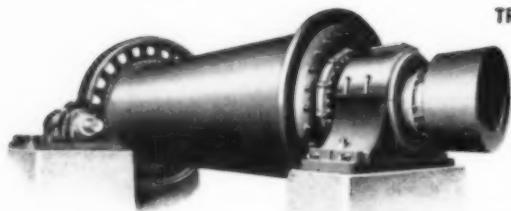
It will pay you to investigate profit-making Traylor Grinding Mills for your new plant or for replacement.

Write today for full information.

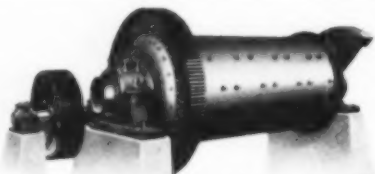
TRAYLOR ENGINEERING & MANUFACTURING CO.
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Sales Offices: New York, N. Y., Chicago, Ill.,
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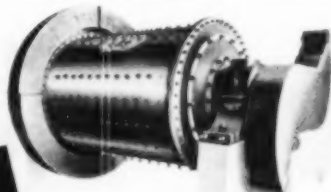
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9'6" x 13'2" Ball Mill for fine grinding in open or closed circuit.



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8' x 20' Compartment Mill takes material through several stages most economical.

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GYRATORY, JAW AND REDUCTION
CRUSHERS • ROTARY KILNS,
COOLERS AND DRYERS

A "Traylor"

Leads to Greater Profits

Chemical Engineering News

RICHARD F. WARREN, Assistant Editor

CCDA to Hold Meeting at Niagara Falls

The Commercial Chemical Development Association will hold an open meeting, at the Niagara Hotel, Niagara Falls, N. Y., on June 24, 1949. George F. Rugar, assistant manager, technical service division, Diamond Alkali Co., Painesville, Ohio, is chairman of the meeting. A special program of activities is being arranged for the ladies.

At the morning session a paper will be given by W. J. Riley, manager technical sales division, Westvaco Chemical Division, Food Machinery Corp. on "Continuing Development of Markets for Old Chemicals." J. S. Reichert, Manager, peroxide products development, electrochemical department, E. I. du Pont de Nemours & Co., will discuss "Hydrogen Peroxide—Development from a Fine to a Heavy Chemical."

At the luncheon R. B. MacMullin, of R. B. MacMullin Associates will speak on "The Chemical Industry of the Niagara Frontier."

In the afternoon R. A. Lindsey, heavy chemical sales division, Dow Chemical Co., will speak first on "The Story of Hydrochloric Acid." The second paper, by J. M. Gillett, director of industrial research, Victor Chemical Works, will be on the subject "Phosphorus Compounds—Organic Derivatives Plus Inorganic Chemicals Have Produced a Big Market." A third paper, on sulphuric acid as a barometer of industrial activity, is expected.

The dinner speaker, E. C. Crocker, of Arthur D. Little, Inc., will speak on "Flavors, Spices and Perfumes."

Schenley Starts New Pollution Control Unit

Patapsco River's north branch will be tapped sometime in 1950 to increase Baltimore's present water supply by 50,000,000 gal. per day. This was emphasized recently when an official group witnessed the groundbreaking for the new, modern wastes treatment plant being built by Schenley Industries, Inc., whose distillery is situated on the river.

This new plant, to be completed by November 1949, is expected to raise the purification of total wastes from the Cedarhurst distillery to 99.9 per-

cent to meet the high standards of the State Water Pollution Control Commission, the State Health and Baltimore City water departments; and the Game and Inland Fish Commission. For the past nine years 98.2 percent of these wastes (spent liquid mash), have been converted into cattle feeds through processing in a by-product recovery dryhouse. Now practically all of the remaining 1.8 percent of mash liquids are to be purified by this new treatment system.

The Cedarhurst project is the Schenley company's 16th successive installation since 1933 in its \$3,500,000 program to prevent stream pollution in Maryland and five other states. It also is an outstanding example of the practical results to be achieved in stream betterment when public officials and private industry work together for community health and progress as they did in this case.

Cold Rubber Plant Dedicated At Baton Rouge

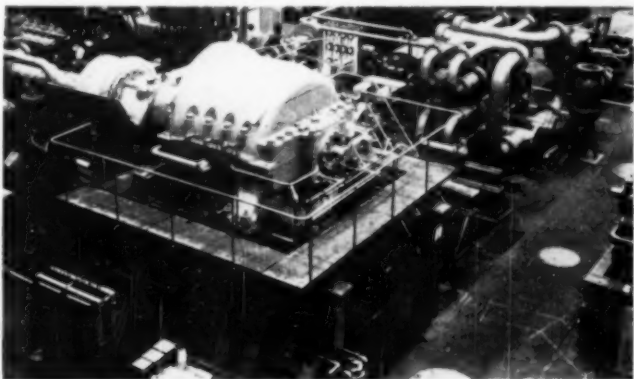
The Copolymer Corp. and Phillips Petroleum Co. were hosts on May 24 at Baton Rouge, La., to commemorate the total conversion of the govern-

ment-owned synthetic rubber plant to the production of "cold" rubber. Copolymer operates the plant.

Guests spent the morning inspecting the installation and lunched at the Baton Rouge Country Club, where they heard addresses by officials of Phillips and Copolymer. In the evening, Charles F. Kettering, vice president, General Motors, talked before an informal dinner for the guests at the Roosevelt Hotel, New Orleans.

Surplus Nitrogen Trends Worry Producers

Nitrogen chemical manufacturers are caught in a combination of difficulties in planning future sales, especially to the fertilizer industry. Much of the difficulty anticipated is still prospective, but is seriously concerning executives in a dozen large firms. Most of these companies feel the price of nitrogen chemicals for fertilizer use is bound to decline somewhat this year. An even larger percentage apparently knows that a substantial surplus is in the making. Those who don't anticipate price declines, at least in their comments for (Continued)



HYDROCOL WILL GET THESE COMPRESSORS

Compressors and expanders for Carthage Hydrocol's oxygen plant are shown under test at Clark Bros. Co. in Olean, N. Y. A straight line combination of three of these new-type units will comprise the largest single shaft compressor ever built. When the first synthetic fuels plant at Brownsville, Tex., is completed late this year, it will include the largest installation of centrifugal compressors in the world. It will have 24 units consisting of more than 80,000 installed horsepower.



(No. 2)

What Is Activated Carbon?

A user asked that question and followed up with: "And how does it get activated?"

Most forms of carbon produced by charring organic matter have, to some extent, that unique property of removing impurities from liquids which is called adsorption. Activation is obtained by so controlling the charring process that the carbon produced has the property of adsorption to a maximum degree.

Suitable raw materials for making activated carbon include wood or wood charcoal, lignite and black ash, a by-product of paper manufacture. In general, activated carbon is furnished in either powdered or granular form. The powdered grades are applied by stirring them into the liquid to be treated then removing the carbon by filtration. Granular grades are applied by percolating the liquid through a bed of carbon.

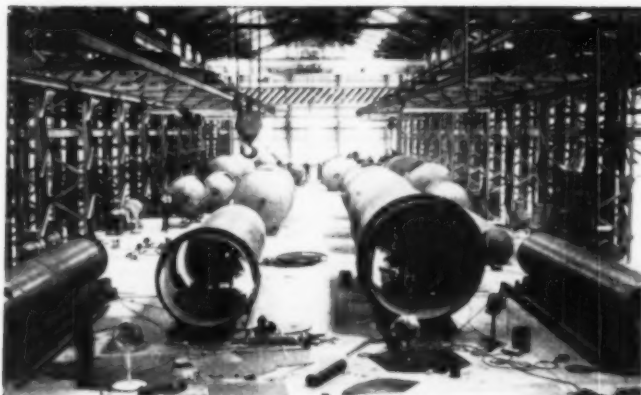
This, in brief, disposes of that puzzling word "activated." We sneaked in another puzzling word: "adsorption." In our next column, we'll try to tell you something about that.



DARCO
CORPORATION

60 East 42nd St., New York 17, N. Y.

News, cont. . .



TANKS FOR CHEMICALS

A large tank fabricating unit in Tulsa has been completed. Tanks and towers for the processing industries are shown under construction at the new unit. The plant, a National Tank Co. unit, was opened recently.

publication, will probably not be hard to persuade as to the trend by mid-summer.

Every major producer of ammonia by synthesis, except perhaps two, will have greater production capacity available at the beginning of the fall selling season than he had a year ago. And even these two expect increased output facilities available next spring. This situation puts the four ordnance-owned government plants, the TVA government plant, and the strictly commercial producers all on the same spot with respect to the prospect of a buyers' market.

The composite capacity now available or soon to be completed could operate regularly year around at an average of approximately 5,000 tons of ammonia per day or 1.5 million tons per year of N. Of this 5,000, fully one-fifth is new capacity which did not exist in 1947. An additional 500 tons a day is being talked about by TVA, Mathieson, and Mississippi Chemical.

Farmers are currently taking something over a million tons of nitrogen per year from industry. Sales for net export plus non-fertilizer industry requirements are not above a half million tons per year. The total of these requirements, about one and a half million tons of contained nitrogen per year, just equals under current conditions the synthetic nitrogen supplied. This leaves as potential surplus more than 200,000 tons per year of byproduct and organic nitrogen.

Until lately producers anticipated some relief for the nitrogen surplus by conversion of synthetic facilities from ammonia to methanol. That

shift is not now likely to materialize as was expected, because the methanol market also has shrunk substantially, a result of surplus alcohol production. With even greater supplies of molasses for alcohol making ahead, the prospect is not attractive, especially in the anti-freeze market where alcohol and methanol compete almost on equal footing from the standpoint of customer convenience and cost.

Substantial increase in conversion of ammonia from anhydrous to sulphate form has occurred and additions to that capacity are under construction. This will somewhat relieve the pressure on ammonia makers as the sulphate can be used generously in mixed fertilizers beyond the limits to which anhydrous and nitrate forms may go. But it does not lower the total N available.

Any price of surplus forecasts are necessarily somewhat speculative until aggressive selling begins in the early fall. At that stage the field men of the fertilizer companies start traveling around the country making arrangements through their dealers for winter and spring distribution. Only then does the best informed member of the industry begin to know with any certainty how much he can expect to market and what price the market will stand.

Manganese Sulphate Plant Is Planned

Production of manganese sulphate in Arkansas by a new company, Inland Chemical Corp., is expected to begin late this summer. A few weeks ago one of the officials said that in all likeli-

hood the plant will be established in North Little Rock, close to the sulphuric acid plant formerly owned by Southern Acid and Sulphur Co., which has been acquired by Mathieson Chemical Corp.

Present plans are that manganese oxides, "wad ores," will be received by the new company by railroad from Batesville, Cushman and other localities in Independence County. The sulphate will be the principal product, but byproducts are also contemplated. The wad ores are reported to contain between 15 and 50 percent manganese.

The Inland Chemical plant initial investment is expected to approximate \$75,000. Alonzo D. Camp, an attorney of Little Rock, is president.

The new enterprise might be connected with the fact that the Standard Mining Co. was planning in May to produce 2,000 tons of manganese ore per day in the Cushman manganese field. It is understood that Standard has leased the R. B. Potashnick flotation mill and several manganese tracts in the vicinity. Inland Chemical has been conferring with Standard with respect to possible future purchases of ore.

U. S. Rubber Installs Cold Rubber Equipment at Borger

U. S. Rubber Co. has completed the installation of equipment needed to produce its share of synthetic "cold" rubber at the plant it operates for the government in Borger, Tex.

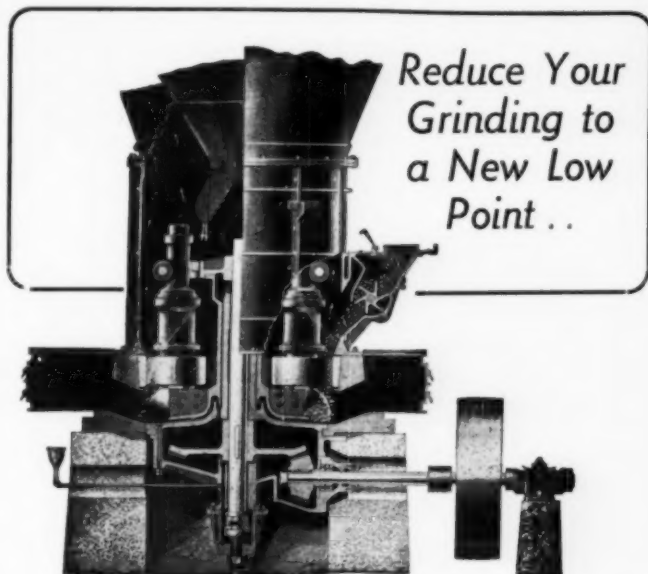
The plant has completed a 66 percent authorized change to cold rubber. It is stepping up production of the superior synthetic to a rate of 5,600,000 lb. per month and will turn out 3,200,000 lb. in May, according to J. C. H. Wendes, the company's synthetic rubber operations manager.

This will be the Borger plant's share of the 33,600,000 lb. of cold rubber which will be produced monthly after October, when other synthetic rubber plants have completed installation of equipment, Mr. Wendes stated.

He added that approximately 60 percent of all general purpose synthetic rubber produced will then be of the cold type.

Hilton-Davis Opens New Beta Naphthol Unit

Six of the eight million pounds a year of additional beta-naphthol capacity are now available, coming from the new \$1,500,000 plant of Hilton-Davis Chemical Co., Cincinnati. The operating company is a subsidiary of (Continued)



Reduce Your Grinding to a New Low Point . .

WILLIAMS ROLLER MILL with AIR SEPARATION

- Greater grinding economy with lowest horsepower per ton of material ground. Positive control of fineness, unusually accurate air separation with no oversize. Instant changeability from a fineness of 70% thru 100 mesh to 99.9% thru 325 mesh. Very high output on unusually fine products. Drying and grinding in one operation. Hundreds of successful installations in the Chemical field attest to their dependability.

Williams Mechanical Air Separator

Designed to handle material that has already been ground or to take the fines out of any dry material that it is desirable to classify. Usually operates in closed circuit with a pulverizer and may be used in this way with almost any type mill. The range of fineness obtainable is approximately from 30 mesh to 325 mesh. Built in nine standard sizes from 2½ ft. to 18 ft.



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**Faster!
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In Higher
Volumes!**

At Lower Cost!



JAY BEE HAMMERMILLS

OPERATE AT TOP EFFICIENCY ON ANY MATERIAL TO BE GROUND

Jay Bee Hammermills are centrifugal in type with multiple cutting hammers that travel at speeds in excess of 20,000 ft. per minute. Material fed into the mill is suspended over the hammers until it has been shattered to size. Finished particle size range from minus 1/64" to 1 1/2". For additional information, write to J. B. Sedberry, Inc., Franklin, Tennessee, for folder CE-449

THE ONLY MILL WITH CONSTANT FEED CONTROL

The new, revolutionary "Constant Feed Control" creates "Suspension Grinding." There is no rubbing between metal surfaces or screens, still, JAY BEE grinds many materials to powder fineness if desired.

FREE GRINDING TESTS OF YOUR MATERIAL

Send us a sample of the material that you wish to grind and advise us to what fineness you wish it ground, capacity per hour and power available. We will return the ground material with recommendations as to the mill best suited to your needs. There is no charge for this service.

J. B. SEDBERRY, INC.

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News, cont. . .

the Sterling Drug Co. Raw material is naphthalene and the product is produced by sulfonation and caustic treatment of the naphthalene. Majority of production will be used by the producer as a raw material for printing ink pigments.

Oil Chemists Elect Officers At Annual Meeting

Election of officers was held at the 40th annual meeting of the American Oil Chemists' Society in New Orleans May 10-12, 1949. Following men were elected: president—V. C. Mehlenbacher, Swift and Co., Chicago; vice president—J. R. Mays Jr., Burrow-Adge Laboratories Inc., Memphis; members-at-large—A. E. Bailey, Girdler Corp., Louisville, Ky.; T. H. Hopper, Southern Regional Research Laboratory, New Orleans; L. B. Parsons, Lever Brothers Co., Cambridge, Mass.; secretary—H. L. Roschen, Swift and Co., Chicago; treasurer—J. J. Vollertsen.

Past presidents who will serve on the governing board with the officers are C. P. Long, Procter and Gamble, Cincinnati; R. T. Milner, Northern

(Continued)

CONVENTION CALENDAR

American Leather Chemists Ass'n., summer meeting, Hotel Monmouth, Spring Lake, N. J., June 22-24.

Commercial Chemical Development Association, summer meeting, Niagara Falls, N. Y., June 24.

American Society for Testing Materials, Chalfonte-Haddon Hall, Atlantic City, N. J., June 27-July 1.

United Nations Scientific Conference on the Conservation and Utilization of Resources, Lake Success, N. Y., August 17-September 6.

American Institute of Chemical Engineers, regional meeting, Mount Royal Hotel, Montreal, September 6-8.

American Chemical Society, 116th national meeting, Atlantic City, N. J., September 18-23.

American Gas Ass'n., annual convention, Chicago, October 17-21.

Packaging Institute, annual forum, Commodore Hotel, New York, October 24-26.

Technical Association of the Pulp and Paper Industry, engineering conference, Statler Hotel, Boston, October 21-November 3.

22nd Exposition of Chemical Industries, Grand Central Palace, New York, November 28-December 3.

American Institute of Chemical Engineers, annual meeting, William Penn Hotel, Pittsburgh, Pa., December 4-7.

IT PAYS TO MAKE "ONE MANUFACTURER"

RESPONSIBLE FOR ALL YOUR GEARS AND SPEED REDUCERS

PHILLIE
GEAR



Herringbone Reducer



Vertical Worm Reducer



Worm Reducer

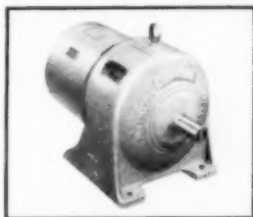


Limitorque Valve Operator

We design and manufacture "every type and size" of Gear and Speed Reducer . . . This fact is *important* because: (1) It assures the purchaser of our "unbiased" recommendations; (2) Permits ordering from "one source" of supply; (3) Enables the purchaser to place the *responsibility* for the operation of their Gears and Speed Reducers upon the shoulders of "one manufacturer."

Your inquiries are invited for information on any type of Gear or Gear Driven Product which includes the widely used "Limitorque" Motor-Operated Valve Control.

Send for catalog on any product, and please use your Business Letterhead when requesting same.



Philadelphia GearMotor



Continuous Tooth Herringbones up to 60" diameter. Separated Tooth Gears up to 150" diameter.



Worm Gears up to 150" diameter. Worms to match.



Spor Gears up to 150" diameter. Larger Gears in beveled sections.



Spiral-Bevel Reducer



Planetary Reducer



"AirKooled" Worm Reducer



Vertical Motor Reducer

Philadelphia Gear Works, INC.

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NOW...
you can handle
ANY
Chemical

...with this **NEW** Bucket Elevator

WITH the new Beaumont "MULTI-VATOR", you can handle *any* material—hot, light, fluffy, flaky, fine, coarse, abrasive, fragile or sticky.

This new bucket elevator uses only *one* strand of chain and a double row of buckets for high capacity material handling at *either* low or high speeds.

No particular ratio between bucket speed, head wheel diameter, bucket size and bucket spacing need be maintained. There is no spillage—even at low speeds.

If you are now using more than one type of elevator for different chemicals, you will recognize immediately the trouble, space and expense you can save in stock inventories alone.

And, picture the advantages offered you by the following:

Higher capacity—through use of dual buckets.

Variable capacities—by varying bucket spacing and chain speeds.

Perfect discharge—unaffected by spacing of buckets or speed.

A fixed diameter, flanged head wheel—for maximum speed.

Smaller, structurally stronger casings—of square, boxed-girder design.

Elimination of loading leg—a shallow pit only is required.

Savings on chain—only one strand required, eliminating uneven wear and stretch as on double strand types.

Elimination of sheer pins and step couplings—by traction wheel drive.

You can get complete details on elevator sizes, chain speeds and capacities by requesting new Catalog Sheet 4140.1.

One Contract—One Responsibility—For Bulk Materials Handling Systems

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Designers Manufacturers Erectors BULK MATERIAL HANDLING SYSTEM

News, cont. . .

Regional Research Laboratory, Peoria; S. O. Sorensen, Archer-Daniels-Midland Co., Minneapolis; and R. R. King, Mrs. Tucker's Foods Inc., Sherman, Tex.

The 1950 meetings of the society will be held at Atlanta during the first week in May and in San Francisco in early fall.

Pennsalt Fluorine Chemical Plant Nears Completion

The first operating phase of Pennsylvania Salt Mfg. Co.'s new Calvert City, Ky., fluorine chemical plant will begin this month.

The new \$2,000,000 Calvert City Works will be devoted in its initial stages to the production of sulphuric acid and hydrofluoric acid.

Plans call for future expansion that is expected to make this plant one of the largest in the Pennsalt chain that now extends from Pennsylvania to Washington and from Michigan to Texas, George B. Beitzel, president, said.

The plant area occupies approximately 10 acres of a 500-acre tract owned by Pennsalt. It is located north of Calvert City, between Paducah and the TVA Kentucky dam at Gilbertville, from which electric power is received.

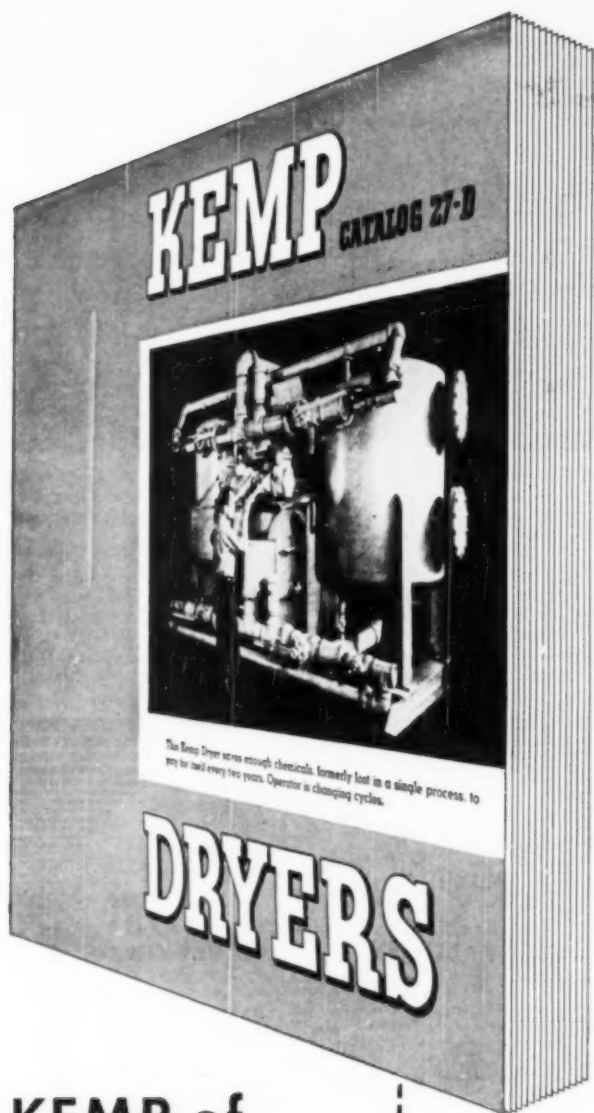
Water necessary for the manufacture of the acids will be pumped from the Tennessee River, 800 yards from the plant. The river also will provide economical transportation facilities. Tracks of the Illinois Central Railroad which service the plant will carry tank cars of the finished products.

James McWhirter, formerly superintendent at Pennsalt's Natrona, Pa., plant, is in charge of the new operation.

SOCAL Plans Expansion of New Refinery at Salt Lake

Salt Lake Refining Co. (a Standard of California subsidiary) has just finished dishing out some \$15,000,000 for a new refinery in Salt Lake City and a pipeline from Rangely, Colo. Now President C. E. Finney, Jr., says that another \$10,000,000 will be spent to expand the refinery at Salt Lake City. This will increase the plant's capacity to process crude from 15,000 bbl. daily to 24,000 bbl.

New equipment will include catalytic cracking facilities of the very latest design; these are expected to be finished by the end of 1950. Work has already started on tankage and other auxiliary items. The present (Continued)



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Cut the cost of Cotton Filter Cloths!

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- Frequently outlast untreated cloth 3 to 1
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- Mildew and rot resistant.
- Maintains filtering capacity.
- Smooth surface.
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- Less shrinkage on press
- May be used in cold or boiling filtrations.
- May be used with hydrocarbon solvents.
- Better filtration.
- Soft, flexible—sews easily

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Information and samples on request

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CARBON BISULPHIDE DID THIS

Last month traffic through the Holland Tunnel was held up for two days as a load of CS₂ burned and exploded. The immediate result was a tightening up on shipments of chemicals passing through New York's tunnels.

crude distillation unit will turn out feed stocks for the new cat cracker. The result will be to (1) greatly increase output of diesel fuels and high-octane gasoline, (2) lower the ratio of heavy fuel oil. The move puts the

company in a favorable position to serve dieselized western railroads.

The refinery will continue to use crude from Colorado's Rangley field, Finney added. But he indicated that

(Continued)

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TANKS AND PRESSURE VESSELS**

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Established 1860 INCORPORATED DEPT. C
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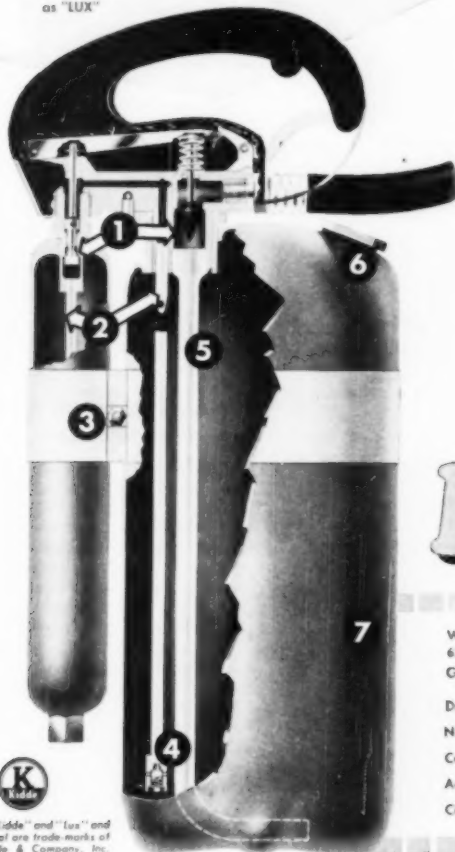
Also fabricators and erectors of Field Storage Tanks, Shells, Bins, Large Bimetal Pipe, and Miscellaneous Steel Plant Work

A New DRY CHEMICAL EXTINGUISHER WITH Trigger-Finger Control

(nothing new to learn)

Here, at last, is an extinguisher that's designed right to make the most effective use of an effective fire-extinguishing agent. Kidde Dry Chemical Extinguishers—made in 20- and 30-pound capacities—are operated simply by pulling a trigger—the same familiar, time-tested method used on all Kidde® carbon dioxide (CO₂) extinguishers.

*Also known as "LUX"



The words "Kidde" and "Lux" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

PLUS these 10 other big features

- 1 Simultaneous opening of CO₂ and powder valves.** No trapping of gas pressure in powder chamber before the discharge starts.
- 2 Quicker transfer of pressure to powder chamber.** Siphon tube carries CO₂ to outlet in powder chamber, where it expands to a gas.
- 3 CO₂ cartridge easily replaced.** Just loosen name band holding cartridge—then unscrew cartridge. Same size cartridge for both 20- and 30-pound extinguishers.
- 4 CO₂ fluffs up powder—prevents packing.** Small port at bottom of CO₂ outlet tube allows gas to stir up powder.
- 5 Powder discharges from top through siphon.** No danger of packing at hose connection.
- 6 Powder filler cap needs no tools.** Unscrews easily for refilling of extinguishers in the field. Filler cap is safety-vented.
- 7 Lightweight cylinder for ease of carrying.** Pound for pound, the Kidde Dry Chemical Extinguisher packs more fire-fighting punch!
- 8 Better powder dispersion pattern.** Diffusion baffle in horn gives greater coverage, more effective application. No shut-off valve in horn to trap powder under pressure in hose. No rodding out of hose after use.
- 9 Extinguisher tested for operation at -40° F.**
- 10 Improved powder and packaging.** Powder specially processed to make it free-flowing; packed in weatherproof containers. 30-pound carton contains three 10-pound cans—for easy refilling of either 20- or 30-pound extinguishers. 50-pound containers also available.

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Mail the coupon for full information.

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Please send me further information on the Kidde Dry Chemical Extinguisher.

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Company.....

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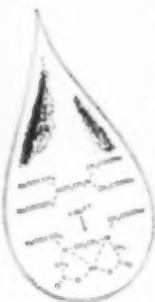
VERSENE Fe-3*

The powerful new sequestant — does more than soften water without precipitation. It actually inactivates troublesome trivalent iron as well as calcium, magnesium and other metallic salts. Until VERSENE Fe-3 was developed, there was no really satisfactory sequestering or chelating agent for ferric iron. At pH 7 10 cc of Versene Fe-3 sequesters at least 167 mg. of Fe_2 plus 158 mg. of calcium. Above pH 9 it is most effective on alkaline earth ions.

VERSENE* (REGULAR)

Is the tetra sodium salt of Ethylene diamine tetra acetic acid and is available in solution or powdered form. Extremely versatile, economical and efficient, it may be used to do a variety of things such as:

- Softening Water Without Precipitation
- Removing Hard Water Deposits And Precipitates
- Dissolving Grease And Food Deposits
- Clarifying Liquid Soap Solutions
- Preventing Oxidation Of Fats, Oils, Soaps, Fatty Acids, Organic Materials
- Stopping Reactions Catalyzed By Metallic Ions
- Aiding In Purification Of Materials
- Separating Metals From Each Other
- Reducing Activity Of Metal Ions



VERSENE* is a pale, clear, straw-colored aqueous solution with total solids approximating 34%. It has an approximate density of 1.2 and an approximate pH of 11.75 in a 1% solution. VERSENE* is also available in crystalline form as a dry white powder. Send for Technical Bulletin No. 1. Ask for Fe, Data Sheet. Samples on request.

*Trade Mark

BERSWORTH CHEMICAL COMPANY
Framingham, Massachusetts

News, cont. . .

eventually some of Utah's own crude — possibly from the rapidly developing Ashley field — might be handled.

Du Pont Licenses Sodium Hydride Production

Du Pont has discontinued the manufacture of sodium hydride and has licensed Metal Hydrides, Inc., Beverly, Mass., to manufacture it under Du Pont patents. Sodium hydride is used in various industrial chemical reactions, particularly in the manufacture of certain pharmaceuticals.

Du Pont said the agreement with Metal Hydrides has no bearing whatever on its sodium hydride metal descaling process where the hydride is formed within the process from metallic sodium and hydrogen.

Walter Kidde Moves Into Southwest Market

Walter Kidde Constructors, Inc., New York, has entered the Southwest through its newly established subsidiary, Walter Kidde Engineers-Southwest, Inc. The new company, with offices in Houston, Tex., at 4101 San Jacinto St., will engage in the design and construction of general engineering projects, including public works, and chemical and other manufacturing installations.

In charge of the Houston division is E. Warren Bowden, vice president and general manager. Bowden, a civil engineer, is a vice president of the parent organization. Prior to the opening of the Houston office he had been in New York City headquarters of Walter Kidde Constructors.

Alcohol Supplement Likely But Not Mixture

Alcohol for automobile motor fuel is finding a sound economic opportunity as a part time supplement to motor gasoline, even though it still finds no great opportunity in automotive fuel mixtures. Recent investigations on a Department of Agriculture test truck suggest the probable official attitude to be expected from now on.

This truck on two trips each nearly 1,000 miles long used a low octane motor fuel with supplemental injection of an alcohol-water mixture as required. Advantages claimed are both conserving petroleum and utilization of alcohol from surplus grain. This implies, but does not prove, that agricultural spokesmen will no longer take the extreme view formerly advocated by "Chemurgic" spokesmen.
(Continued)

Never omit the "Composite Valve" — in any cost-wise planning

CALL IT THE "COMPOSITE VALVE" — the giant that would result if *all* the valves in a plant were *one* valve. As pictured here, its proportion to other equipment in this detailed model of an automobile factory is fairly accurate. Representing your total valve investment, its size may surprise you, but it must be considered in any plan for economical plant operation.

IT PAYS to keep your "composite valve" in mind at all times... and thus avoid the common error of dismissing valves as a comparatively unimportant investment. With wages and material costs the highest

ever, your total valve expense warrants the same careful attention that you give to operating costs of larger plant units.

EXCESSIVE MAINTENANCE of one inferior valve is insignificant, but multiplied by thousands, it is a serious drain on operating budgets. JENKINS BROS. helps you meet this problem two ways. First, by building extra endurance into Jenkins Valves, making them the longest-lasting, lowest-upkeep valves that money can buy. Second, with advice from Jenkins Engineers on any question of prop-

er selection, installation, or maintenance.

For all new installations, for all replacements, rely on Jenkins quality and engineering for lowest valve costs in the long run. Sold through leading Industrial Distributors.

Jenkins Bros., 80 White St., New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; San Francisco. Jenkins Bros., Ltd., Montreal.



"PRACTICAL PIPING LAYOUTS" is a 32-page book containing diagrams and descriptions of 25 basic piping layouts with complete recommendations for valve selection and location in the lines. Tells you "which valve where for best performance". FREE on request. Write JENKINS BROS., 80 White Street, New York 13, N. Y.

LOOK FOR THIS

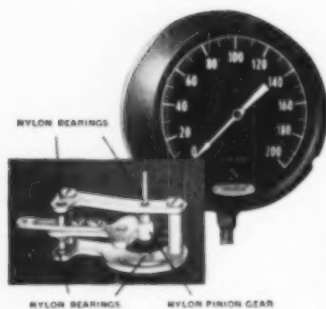


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JENKINS VALVES

Types, Sizes, Pressures, Metals for Every Need





Now—Duragauges with NYLON movements!

A revolutionary new development in the construction of Duragauges is the Nylon Movement. Exhaustively field-tested and employing well established engineering principles, this new movement outwears and outperforms any other gauge movement even under the most severe conditions of vibration and pulsation.

Nylon far surpasses the wearing qualities and corrosion resistance of any material heretofore available for pressure gauge movements. It has an extremely low co-efficient of friction, high resistance to shock loading and excellent vibration-absorbing traits.

With this new Nylon Movement are combined all of the features that have made Duragauge the pace-maker of the gauge industry.

When selecting gauges, look for the name ASHCROFT, a leader since 1856.

Stocked and sold by leading distributors everywhere. If you see a Duragauge, insist on ASHCROFT... It's just for looking.



ASHCROFT
Gauges

A Product of
MANNING, MAXWELL & MOORE, INC.
STRATFORD, CONNECTICUT

Makers of Ashcroft Gauges, Pressure Valves, Compensated Safety and Relief Valves and American Institute Instruments. Builders of Steam-Rollers, Cranes, Hoists and most other hoists and other heavy equipment.

News, cont. . .



COAL IS CONVERTED TO OIL HERE

Heavy reinforced concrete bays encase these converters. They are part of Bureau of Mines "coal to oil" plant at Louisiana, Mo. It was dedicated last month. It contains some of the best high pressure equipment in the world.

The latter argued for requiring a mixture of alcohol with gasoline.

Advantages for separate intermittent injection automatically as needed by the engine are: (1) No necessity for blending with gasoline. (2) use of low octane gasoline without power loss during periods of heavy duty, and (3) use of relatively small quan-

ties of alcohol permitting higher costs than are otherwise economic.

If ethyl fluid demand is cut back by lifting of Berlin blockade, as seems certain, the urgency of getting alternate by alcohol injection may decrease. But the long view need for such alternate continues, officials

(Continued)

Notes on Our Management

WE do not think of Management as the head, heart or a separate section of our organization body. It is an indivisible life-stream that runs through the entire endeavor—intimately working with and nurturing the farthest flung element—concerned with the youngest representative on the road, the smallest customer and the lowliest employee. Its one aim—quality of product and good service.

OLDBURY

ELECTRO-CHEMICAL COMPANY

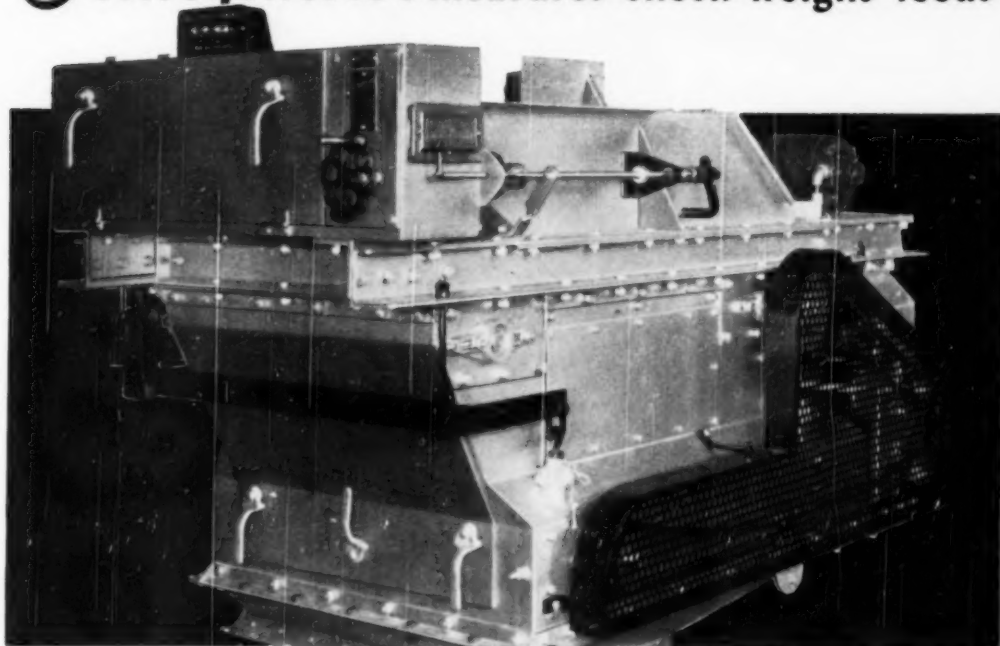
Plant and Main Office:

NIAGARA FALLS, NEW YORK

New York Office:

19 RECTOR STREET, NEW YORK 6, N. Y.

The Conveyometer measures • check-weighs • feeds



and *Self-tests* each weighing

If you are looking for the most accurate way to proportion pebble lime to slaker, quick-lime to hydrator, bauxite to mixer, salt cake to mixing tank . . . or to measure, check weigh and feed any loose, cool, small, crushed, granular or ground material automatically, you'll do best with the Conveyometer.

The only *self-testing* continuous feeder-weigher made. Constant checking of larger unit weighings automatically eliminates slow, dirty, catch-pan, stop watch tests for calibration—and assures closer accuracy percentage-wise.

Two short, slow-moving belt conveyors, one to measure, the other to check-weigh the amount measured, are enclosed in dust-proof housing easily accessible. Outside scale beam and flashing signal lights prove that feeder is measuring accurately. Low and high capacity gears and self-regulating feed gate permit a wide range of loads and hourly capacities. Rugged construction assures long, trouble-free life; compactness of the unit permits installation where low head-room is a factor.

5544

TYPE OF GROUND, DRY OR GRANULAR MATERIALS

Alum • Borax • Lime • Calcium Chloride • Graphite • Carbon Black
Feldspar • Nitrates • Clays • Ores • Talc • Salt • Fullers' Earth
Potash • Sludge • Soda Ash • Phosphates

Handled by RICHARDSON SCALES

A single unit checks repeated equal loads in any number of cycles up to 10 per minute. For proportioning, multiple units, driven by line shaft, feed ingredients to collector conveyor prior to blending, assuring a uniformly mixed end product.

Why not let a Richardson representative show you how the Conveyometer can help cut process control and blending costs in your plant?



MATERIALS HANDLING BY WEIGHT

**RICHARDSON
SCALE COMPANY**
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Omaha • Montreal • New York
Philadelphia • San Francisco
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Interstate
Transportation*

ALSO
**HERCULES
(CORK CUSHIONED)
CARBOY BOXES**

available in
5 & 13 gallon sizes
to comply with ICC-1A

Available in 6½ gallon size
to comply with specifica-
tion ICC-1D

**HERCULES
Aero
(RUBBER CUSHIONED)
CARBOY BOXES**

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GALL.



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HOME OF HERCULES CARBOY BOXES • NEWARK 5, N. J.

PRE-FABRICATED *Stainless* PIPING IN

Any Quantity

FOR PROCESS INDUSTRIES

If you've been just getting by with a "make-shift" piping arrangement or postponing expansion or improvements, there's no need to "put it off" any longer because we can get the alloy materials, particularly stainless steel, in any quantity and give you prompt service. You can rely on our 50 years' experience in pre-fabricated pipe engineering to give you top efficiency and top economy. We pioneered in the early 1930's in developing methods for welding and shop pre-fabrication of stainless steel piping for process industries. We use the latest "inert-gas-shielded-arc" welding and insides of welds and joints can be made absolutely smooth. Today, most utilities and large industrial plants have experienced the perfection of our patented Westport Welded Joint and other high pressure, high temperature pipe engineering and pre-fabrication. Write or send your prints for an estimate.

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PIPING FABRICATORS AND CONTRACTORS

News, cont.

claim, especially when any later military emergency may create again the difficulty in securing high octane blending agents, lately so scarce. New tests seem to put both military influence and Department of Agriculture back of comparable programs instead of in opposite camps.

**AIChE Meets
In Tulsa**

Latest regional meeting of the AIChE was held in Tulsa. Feature of the technical meeting was a symposium on chemical engineering economics. Of most interest were papers on "The Value of Money" by F. C. Broach, vice president of the National Bank of Tulsa, and a paper by R. S. Aries of R. S. Aries & Associates and John Hoppel of NYU entitled "Venture Profitability in Economic Balances."

Broach foresees that, although prices may come down somewhat, the general price level will remain substantially higher than prewar. This is due, he feels, to the fact that the money supply has increased at a far greater rate than production. Mr. Broach does not expect that production will return to its prewar relation to money supply. "We have and will continue to have a devalued dollar as measured by former standards," he said.

Drs. Hoppel and Aries coined a term they call "venture profit." By this term they mean the profit that a prospective venture yields, above the return on the investment that management feels such a venture must have. By use of this "venture profit" idea, the speakers compared different ventures having different investment, sales, and profit totals. The speakers feel that a comparison of the differences in venture profit of the projects is more illuminating than comparing the over-all return on investment that the different projects show.

Professor Walter G. Whitman, head of the chemical engineering department at M.I.T., pointed out that frequently reports and work of younger engineers are the basis for policy decisions by management. He urged that younger men have "thorough, honest and enlightened thinking."

**Pan-Am Extends Its
Fellowship Program**

Pan American Refining Corp. has announced that it will continue during the 1949-1950 academic year its policy of granting graduate fellowships (Continued)

Solving New Corrosion Problems

Operating Tests Show Superiority of Copper and Its Alloys

Intensive research in the chemical and petro-chemical fields continues to bring forth new and important products which call for improvements in existing plants plus a tremendous expansion program.

In the chemical field, plans for the next five years call for capital expenditures between four and five billion dollars. The petroleum industry also plans to spend approximately three billion dollars in the same period.

Pilot Plant Testing Recommended. Since new products and new methods bring new problems in corrosion, much can be done to gauge the performance of materials before specifying them for new installations. Trying out various metals in the pilot plant stage rather than in the laboratory is advisable in order to duplicate as nearly as possible actual operating conditions. This is necessary because the introduction of traces of other materials into a relatively pure chemical as used in laboratory tests can often lead to marked changes in corrosion behavior.

Bridgeport Laboratory will be glad to cooperate along these lines by submitting sample lots of single-walled tubing, duplex tubing or test coupons for observation since much experimental work of an exploratory nature must be undertaken on products and combinations of chemicals whose behavior is not known.

Advantages of Copper and Its Alloys. Since the objective of chemical engineers is to operate their plants on a continuous basis, materials both of a reliable nature and moderately priced must be used to make this practical. Low maintenance, minimum of shutdowns, and prevention of contamination are obtained under most operating conditions from copper-base alloys which have the following characteristics:

1. Good corrosion resistance.
2. Mechanical strength to withstand the necessary working pressures.
3. High heat transfer properties, maintained for long periods without loss of efficiency.

The corrosion resistance of copper and copper-base alloys in fresh water, sea water, numerous liquids and gases, and atmospheres accounts for their wide use in such media. Not only are they moderate in cost but their ease of fabrication makes them well suited for applications requiring cold or hot

working in the performance of fabricating operations, such as bending, forming, spinning, cupping, stamping and deep drawing. From a heat conductivity standpoint, copper has the highest value among commercial metals. For these reasons copper and its alloys are the first choice for use in the construction of heat exchangers, condensers, water heaters, radiators, air conditioning and refrigerating equipment, kettles, etc.

Mechanical Properties Retained at Low Temperatures. The addition of alloying elements, such as zinc, nickel, tin, aluminum, and silicon, increase the strength and hardness of copper. The effect on corrosion resistance varies with the environment.



Fabricating Lubricating Oil Coolers—Courtesy Condenser Service and Engineering Co., Inc., Hoboken, N. J.

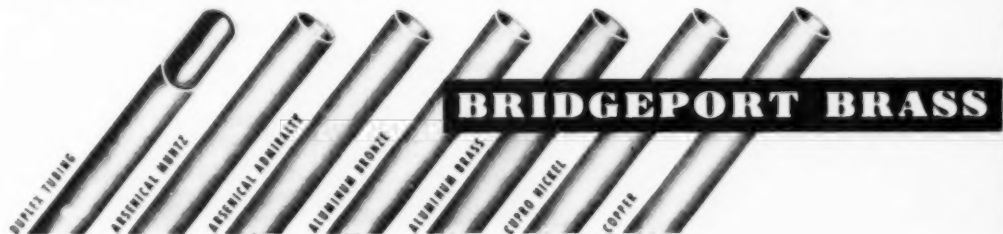
Copper and its alloys, however, lose a substantial portion of their mechanical properties values at temperatures above 600° F, which limits their use to operations in the higher temperature field. On the other hand, copper-base alloys retain most of their excellent physical properties at sub-atmospheric temperatures, which cause many ferrous alloys to become brittle. This is of particular importance in selecting materials for handling, at low temperatures, gases such as oxygen, nitrogen, hydrogen, carbon dioxide, air, etc., in liquid form. Copper and its alloys are performing well in such low temperature work as dewaxing, and handling and storing of refrigerants.

We would like the opportunity of working with engineers of chemical and petro-chemical plants on their maintenance and corrosion problems. Contact the nearest Bridgeport sales office. Write for Condenser Tube Manual and Duplex Tubing Technical Bulletin No. 746.



BRIDGEPORT BRASS COMPANY
BRIDGEPORT 2, CONN. • Established 1865
Mills at Bridgeport, Connecticut, and Indianapolis, Indiana
In Canada—Noranda Copper and Brass Limited, Montreal

CONDENSER AND HEAT EXCHANGER TUBING



SAFETY FIRST



WHEREVER
DUST,
EXPLOSIVES,
INFLAMMABLES
OR FUMES
CREATE
A HAZARD

WHEELER
SELF-POWERED
TELEPHONES

**ABSOLUTE PROOF AGAINST
SPARKS and FIRE HAZARD
CORROSION RESISTANT**

No batteries or other power connections are used for voice transmission or bell. Transient noises are eliminated, leaving the voice clear and distinct. Operation cannot fail due to loss of power. Compact and convenient. Efficient up to 20 miles. Comparable in quality and size to standard telephone sets. Coiled Kord equipped for convenience and long service. See your jobber or write today for booklet SA-8.

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DIVISION OF THE SPERRY CORPORATION
MAGNET WIRE • COILS • BALLASTS

News, cont.

in chemical engineering and chemistry. Fellowships in chemical engineering are being continued at Massachusetts Institute of Technology, University of Illinois and Rice Institute. The company is continuing its chemistry fellowships at Ohio State University, University of Texas and University of Oklahoma.

New Plant Is Now Turning Out Semichemical Pulp

For the first time, semichemical pulp is available on the market in commercial quantities. This was announced by George Kress, president of the Green Bay Pulp and Paper Co., Green Bay, Wisconsin. This company's new pulp mill started operations late in March.

Marketed at a price equal to that of ordinary unbleached sulphite, the output of the new plant is approximately 50 tons per day of neutral sulphite pulp. Heretofore, all manufacturers of semichemical pulp have used their product in their own papermaking operations and it has not been available to other mills in quantities sufficient for full scale operations.

The principal advantage of the semichemical process is that it utilizes a

greater portion of the wood than conventional chemical pulping methods. Made from poplar, this neutral sulphite pulp is a short fibered, easily refined pulp with good drainage characteristics, and it is suitable for a variety of grades of paper and board. Its availability will permit mills contemplating the manufacture and use of such pulp to determine its suitability in their own particular grades of paper.

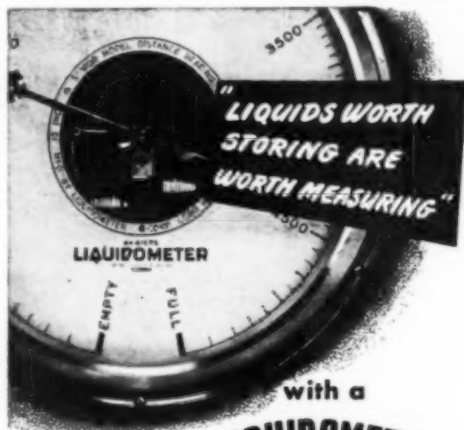
Bakelite Plans Phenol Plant in Ohio

Bakelite Corp. plans to erect a phenol-producing plant south of Marietta, Ohio. Construction has not yet begun, but it is expected that the plant will be in operation late in 1950.

This new plant will produce phenol from chlorobenzene under a patent granted to the late Dr. L. V. Redman, formerly vice president and director of research of Bakelite.

The plant will be an important part of a continuing expansion program that enabled the company to increase average production capacity by approximately 50 to 60 percent last year. This expanded productive capacity during the past year included the completion of a new plant at Ottawa, Ill.

(Continued)

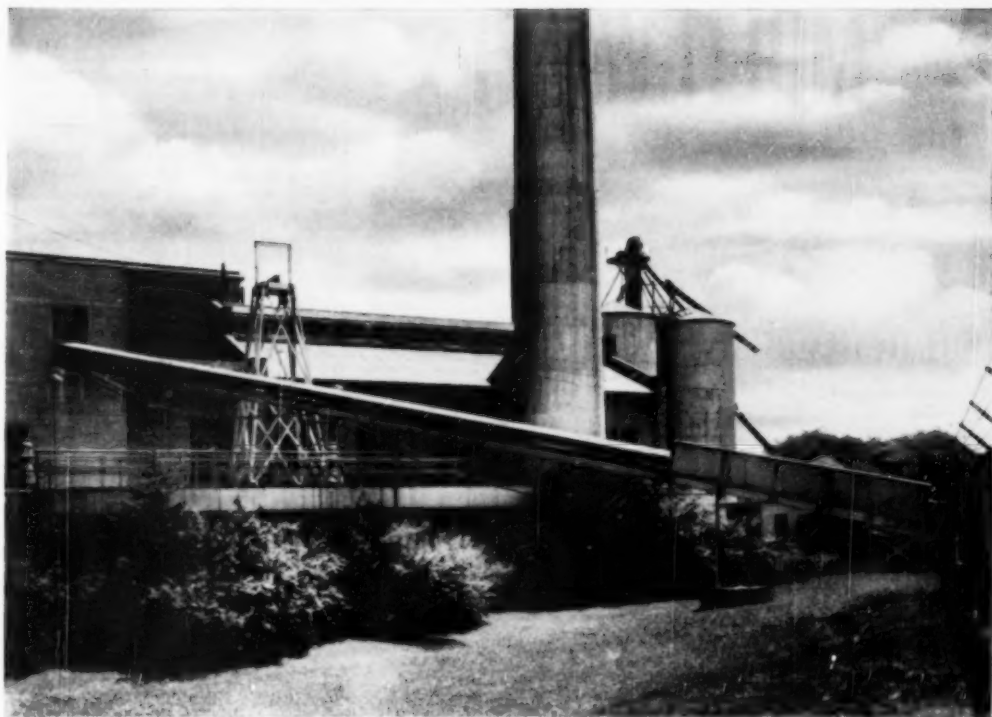


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- 100% AUTOMATIC
- APPROVED BY UNDERWRITERS' LABORATORIES

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LIQUIDOMETER
Tank Gauge

WRITE FOR COMPLETE DETAILS

THE **LIQUIDOMETER** CORP.
36-29 SKILLMAN AVE., LONG ISLAND CITY, N.Y.



Taking the "PUCKER" out of Alum Handling

This specially designed S-A conveyor system takes the "Pucker" . . . the back-breaking work . . . out of alum handling at this modern plant. 100 lb. bags of alum go from car to storage in only 30 seconds . . . with no spoilage by weather.

The broad experience of S-A engineers in the design of conveying systems always results in low cost efficient installations. Each system is designed to meet specific requirements . . . to handle maximum tonnage at lowest cost.

You'll want the recommendations of this trained staff of S-A engineers . . . whether you plan to install a new unit or want an entirely new bulk materials handling system. Write today.

Alum, in 100 lb. paper bags, slides from car down chute to lower end of a 92 foot long S-A flat belt conveyor which conveys bags at the rate of 15 TPH to 3rd floor storage. This complete S-A conveyor system is entirely under cover . . . permits handling of bagged chemicals in any kind of weather.

STEPHEN S-A DAMSON

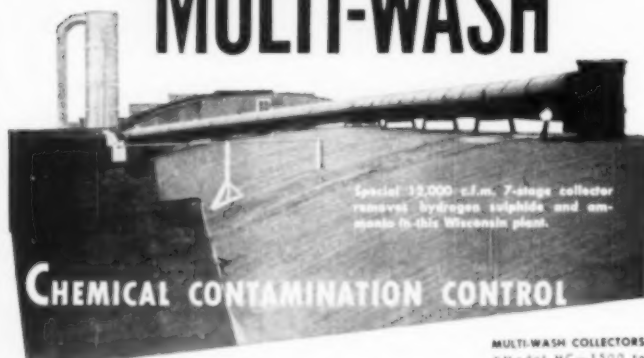
3 Ridgeway Avenue, Aurora, Illinois MFG. CO. Los Angeles, Calif. • Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

CHEMICAL ENGINEERING—June 1949

223

* MULTI-WASH

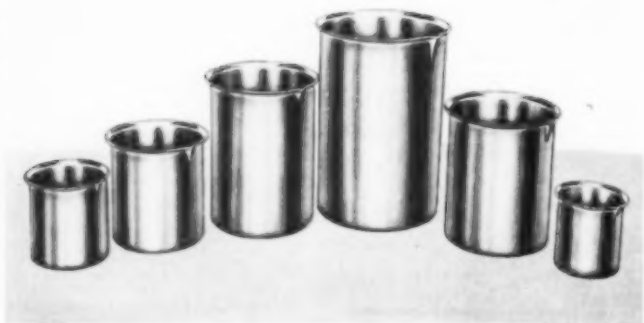


Special 15,000 c.f.m. 7-stage collector removes hydrogen sulfide and ammonia in this Wisconsin plant.

CHEMICAL CONTAMINATION CONTROL

ELIMINATE dangerous, damaging chemical fumes and gases . . . improve working conditions . . . reduce labor turnover. Schneible Multi-Wash absorbs the valuable, toxic or nuisance creating material in a proper liquid media. No moving parts except fan and re-circulating pump. Install at roof or outdoors. Write for names of prominent Chemical Users! Claude B. Schneible Co., 2827 Twenty-Fifth St., Detroit 16, Michigan.

MULTI-WASH COLLECTORS
Model MC—1500 to 30,000 c.f.m. or multiple units for larger capacities.
Model JC—1,000 to 30,000 c.f.m. or in multiple units.



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• Same capacities and dimensions as standard glass beakers. Available from stock in 304 Stainless Steel or Monel Metal. Other analyses on request. Highly polished

Stainless Steel or Monel Full line available from stock

all over. Highest quality and durability.

Get prices.

METALSMITHS



Division of
Orange Roller Bearing Co., Inc.
554 White Street
Orange, N. J.

Also in stock: Pails, measures, dippers, funnels, scoops, dye and starch buckets, stock pots, batch cans, shovels.

WRITE FOR ILLUSTRATED PRICE LIST

News, cont. . .

and increased manufacturing facilities at the Bound Brook, N. J. plant. During 1949 it is expected that these facilities will be augmented by construction of a new plant at Belleville, Ont., Canada, which will produce phenolic plastics and resins and urea resin adhesives, and the construction of a woodfloor plant at West Bath, Me., designed to produce only part of the company's expected woodfloor requirements.

Tennessee Eastman Sets up Fellowships in South

Tennessee Eastman Corp. has established fellowships for graduate work in chemistry or chemical engineering in five southern universities for the 1949-50 academic year.

A fellowship of \$1,200 toward a Ph.D. in organic chemistry has been given to University of Tennessee. University of North Carolina and Emory University. A \$1,200 fellowship has been established at Georgia Tech for Ph.D. work in chemical engineering, and a \$750 fellowship toward a master's degree in chemical engineering at Virginia Polytechnic Institute.

Briefs . . .

Polytechnic Institute of Brooklyn. Brooklyn, is presenting four summer laboratory clinics during the period from June 6 to July 29 under the auspices of its Institute of Polymer Research and its Division of Applied Physics. "Industrial Applications of X-ray Diffraction" is scheduled from June 6 to June 17. "Advanced X-ray Diffraction" from June 27 to July 2. "Molecular Weight Determination of Polymers" from June 27 to July 1, and "Polymerization Techniques" from July 25 to July 29.

Technical Appliance Corp., Sherburne, N.Y., has appointed Kendrick H. Lippitt chief engineer.

H. K. Ferguson Co. has completed a new antibiotics laboratory in Detroit for Parke, Davis & Co.

Edward Valves, Inc., East Chicago, Ind., has announced that W. B. Osgood has become a partner in the Dunbar Engineering Co., New York, representing Edward.

Ames Engineering and Testing Service, Ames, Iowa, has announced that W. J. Wride has purchased half interest in the company. The other half interest is retained by Richard J. Gayer. —End

Do you measure salt by RULE OF THUMB?

For Accurate Salt Measurement "PASS the SALT" by LIXATOR*

RULE of thumb measurement of salt by volume, in bucket or shovel, or by weight is inaccurate and wasteful.

For example, in measurement by dry salt volume, one cubic foot of dry salt will weigh *anywhere* from 66 to 84.5 pounds. And measurement by dry salt weight is "guesswork," too, for salt may contain from .05% to 5.0% moisture depending upon humidity, length of time in storage, varying bulk and area of the stock pile.

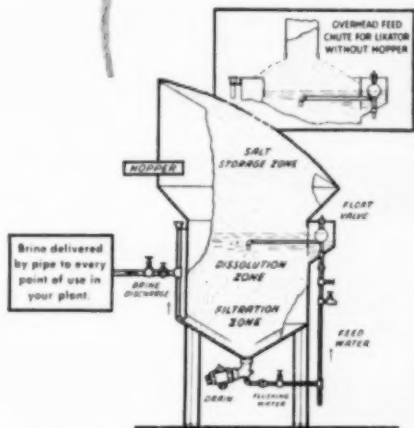
BUT... with the Lixate Process salt measurement is *exact*. Each gallon of Lixate Brine *always* contains *exactly* 2.65 pounds of Sterling Rock Salt. For the Lixator *automatically* makes 100% saturated, crystal-clear, self-filtered brine, that meets the most exacting chemical and bacterial standards. And this brine can be *easily* and *accurately* diluted volumetrically to any desired strength.

In the production of chemicals, leather, textiles, plastics, soap, sulphonated oils, petroleum, food products...in the operation of refrigeration systems and in regenerating zeolite water softeners...accurately measured Lixate Brine cuts salt requirements 10% to 20%. And it also eliminates costly handling, mixing and stirring of salt.

Consult our Technical Service Department on your use of salt and brine. The experienced men on this staff will advise you on the proper location for Lixator and salt storage, pumping arrangements, types of pumps, meters, and valves. They will fit the *money-saving* Lixator into your plant operations. Write today!

The **LIXATE** *Process*
REG. U. S. PAT. OFF.
for making brine

INTERNATIONAL SALT COMPANY, INC.
Scranton, Pa.



HOW THE LIXATOR WORKS—In the dissolution zone—Flowing through a bed of Sterling Rock Salt which is continuously replenished by gravity feed, water dissolves salt to form 100% saturated brine. In the filtration zone—Through use of the self-filtration principle originated by International, the saturated brine is thoroughly filtered through a bed of undissolved rock salt. The rock salt itself filters the brine. Nothing else is needed.

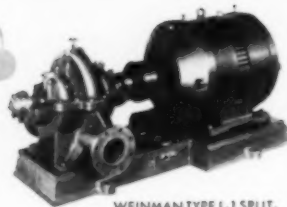
NOW AVAILABLE
The New Stainless Steel
STERLING* MODEL LIXATOR*

For "Lifetime" Use
For Greater Economy
For Added Cleanliness

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handle
liquids
profitably
with
WEINMAN PUMPS



WEINMAN TYPE L-1 SPLIT-CASE PUMP combines all the most desirable features of modern hydraulic and mechanical design. Capacities to 3500 G.P.M.

The Chemical industry operates profitably *only* if production equipment keeps turning out a full day's work at maximum efficiency—every day—at a minimum overall cost. That's why you find so many WEINMAN Pumps on the job in Chemical Processing. Let a WEINMAN Centrifugal Specialist show how you can cut your liquid handling costs and assure your plant day-in, day-out, trouble-free pumping service. Most WEINMAN models and sizes are available in All-Bronze, All-Iron, All-Nickel, All-Aluminum and All-Stainless Steel construction. Your inquiry—by letter, wire or phone—will get prompt attention from a WEINMAN specialist—a CAREER MAN IN PUMPS.

Built by Centrifugal Specialists
The WEINMAN Pump Mfg. Co.

300 SPRUCE STREET • COLUMBUS 8 • OHIO



Here's a signpost to guide you to a long established and dependable supplier of electric melting tanks, kettles, pots and accessories for countless applications throughout the chemical industry.

Sta-Warm builds chemical compound melters in capacities from one pint to hundreds of gallons. In types and shapes to suit your requirements. With temperature ranges and tolerances you specify. With minor accessories to suit the application.

Every Sta-Warm melter, whether standard or of specially engineered design,

is supported by 30 years of experience in building thousands of successful installations for America's largest and most critical buyers.

Outline your chemical compound heating or dispensing problem to Sta-Warm for sound, helpful solution. No obligation.



**READERS' VIEWS
AND COMMENTS**

Magnesia Pulping

To the Editor:

Sir:—I have read your interesting article, "Magnesia Pulping Process" appearing in the *Chemical Engineering* of February 1949 (p. 137).

The article is indeed very enlightening. I must say, however, that your claim that the Weyerhaeuser Timber Co. at Longview, Wash., is the only mill in the world trying this process is difficult to accept.

If you mean that the above company is the first mill in the world to try and make magnesia base wood pulp, then I have nothing to say.

I have worked on this process very successfully for over 15 years now in India on bamboos available here. In fact the mill is still working very economically and efficiently even today.

I am now interested in the manufacture of soluble cellulose for rayon from bamboos based on the magnesia pulping process and I have succeeded considerably in convincing the governments by Mysore and India and the project is waiting to see the light.

You will agree with me, therefore, that the magnesia base for pulping is not new or that the Weyerhaeuser Timber Co. the first in the world to try it out. If this statement of yours is confined to wood pulping, I have nothing to say.

R. N. Rao

Chamaraj Pet
Bangalore City, India

Southwest Boom

To the Editor:

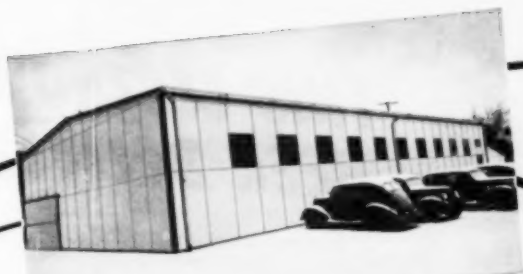
Sir:—This is to call to your attention and correct some erroneous information which appeared in the April issue of *Chemical Engineering*. I refer to the last item in the table at the top of p. 117, in "Southwest Boom."

The plant now under construction at Brownsville, Tex., for separating and refining the chemicals which will be produced by the Hydrocol plant of Carthage Hydrocol, Inc., is a project of the Stanolind Oil and Gas Co. and will be operated by Stanolind.

U. S. Industrial Chemicals, Inc.'s installations at Brownsville, also now under construction, adjoin those of Stanolind. This fact may account for the error noted above. USI's installations consist of storage and shipping facilities for the lower aliphatic alcohols, aldehydes, ketones and acids, which USI will distribute and market.

D. G. Zink
Stanolind Oil and Gas Co.
Tulsa, Okla.

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*1/2" APAC used as siding on new warehouse
of Unistrut Corporation, Wayne, Mich.*



View of same building from opposite side.

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"Century" APAC is the ideal material for industrial buildings of many kinds . . . both in new construction and remodeling. It is economical to use . . . easy to handle and apply, so goes up fast. It requires no protective paint, and maintenance is at a minimum. In fact, APAC actually grows tougher with age.

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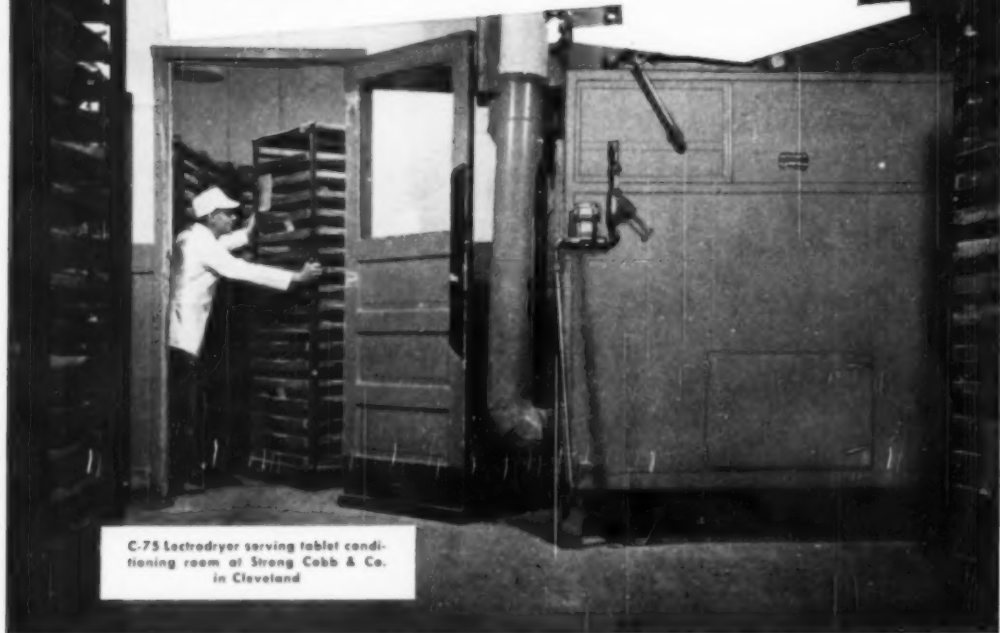
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News From Abroad

SPECIAL CORRESPONDENCE

Dutch Claim Rubber Prices Are Too Low—Blame U. S.

Amsterdam—Dutch rubber authorities were interviewed by McGraw-Hill World News following their return from the London conference of the Rubber Study Group. They indicated considerable dissatisfaction with the proceedings of that conference. If any problem should have been discussed there, they stated, it should have been that of the rubber price, which is much too low for producers. This is particularly true for the small holders, who in many instances have given up their rice fields and are now completely dependent on rubber, with the result that they have to buy their rice at exorbitant prices. This situation, Dutch quarters contend, lays the foundation for communism in Southeast Asia. The American delegation at the conference refused to discuss this problem or to have it studied by the group.

More Steel Capacity Coming to India

New Delhi—Establishment of two new steel plants in India, each with an initial annual capacity of 500,000-600,000 metric tons and costing between \$150 and \$180 million, is the general recommendation of three foreign consulting firms whose reports have just been submitted to the Indian government.

The three firms—Koppers Co. Inc., Arthur G. McKee & Co., both of the U. S. A., and International Construction Co., Great Britain—differ slightly at several points of judgment, and in some assumptions. In general their findings are:

New Plants—Sites in the Central Provinces and in Orissa Province are favored because of accessibility to raw materials. Capital costs per ton of finished product are estimated at roughly \$300, and costs of steel bars and rods in production at between \$60 and \$75 per metric ton.

Raw Materials—Iron ore reserves in the Central Provinces and Bihar province are believed to be virtually inexhaustible and of top quality. Coking coal reserves are held to be good for 150 years if used for that purpose

exclusively. Limestone and dolomite reserves are adequate, and manganese deposits are almost inexhaustible. But refractory production must be sharply increased.

Existing Producers—Improvements and expansion at the plants of India's two major steel makers at a final cost of \$94 million have been approved by the consultants, with the recommendation that the government support them. These are: At Tata Iron & Steel an immediate \$15 million expenditure for repair or replacement of war-worn plant to restore output to the wartime average; later \$25 million for a new skelp mill, a tube-pipe mill and a special alloy and tool steel plants; and at Steel Corp. of Bengal an immediate \$15 million for raising production another 200,000 metric tons, followed by a \$36 million second stage to add a further 220,000 metric tons.

Secondary Producers—Requirements of this industry, including rollers, are estimated at 600,000 metric tons annually, which cannot be met by expanding existing steel plants.

Even with the Tata and SCOB expansions, the consultants estimated, India will be short by a million metric tons. Therefore, the new plants are a vital need and will not result in surplus production.

Canada Holds International Trade Fair at Toronto

Toronto—Chemicals were prominently displayed at the Canadian International Trade Fair. The fair was held from May 30 to June 10 in Toronto and attracted a large number of visitors from the United States. Two Yugoslav cooperatives participated in the industrial chemical section. The two government sponsored agencies, Cetroprom and Yugolek, are

newcomers to the fair. A number of chemicals were displayed. These included alkaloids, acids, caustic soda, lead acetate, tannin, pyrethrum, insecticides, hemp, taw, and a host of other fine and heavy chemicals.

The British firm of May & Baker Ltd. was represented through their Canadian branch by a display of industrial, laboratory, photographic, pharmaceutical and horticultural chemicals. This firm, long in the Canadian market, used the Trade Fair to promote additional exports.

In numbers of firms showing, Canada had the largest representation in this section. Several important concerns such as Canadian Industries Ltd., Canadian Copper Refiners Ltd., Merck & Co. Ltd., Shawinigan Chemicals Ltd. and Eldorado Mining & Refining (1944) Ltd., showed chemicals used in practically every sphere of manufacturing. In the fine chemical field, the following products were shown: bismuth preparations, citrates, iodides, mercurials, penicillin, silver chloride, cyanide and nitrate; streptomycin, strychnine and vitamins. Visitors examined various grades of copper sulphate, selenium and tellurium salts, calcium carbide, acetylene black, lime hydrate, crotonaldehyde, crotonic acid, and ethyl acetate. Radioactive materials for industry, research and medicine included radiography capsules and accessory equipment for testing castings and welds.

This section also included industrial paints and varnishes, shellacs, plastic molding compounds, solvents, polishes, lacquers, anti-freeze bases, fertilizers, waxes, and may other basic chemical materials.

Australia Expands Dry Cell Plant Capacities

Melbourne—A big expansion program is announced by General Dry Battery Pty. Ltd. The firm is a joint subsidiary of General Dry Batteries Inc., Cleveland, Ohio, and Electronic Industries Ltd., Melbourne, Australia.

The chief engineer of the Dubuque, Iowa, GDB plant is in Melbourne to help with the plant reorganization. Equipment is expected to arrive shortly from the U. S.

(Continued)





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FOREIGN NEWS, cont.

The General Dry Batteries-Electronic Industries tie-in developed out of Electronic's wartime patent agreement with Shawinigan Chemicals Ltd., the Canadian firm which makes most of the world's acetylene black for high-grade dry batteries.

Electronic Industries was the first firm outside Canada to operate the Shawinigan process. Capacity of the Australian plant is 600,000 lb. a year. It is located at Electra, Tasmania, adjacent to the plant of the Commonwealth Carbide Co., its raw material supplier.

Because Shawinigan reserved the right to continue supplying Eveready's Australian plant with the carbon compound, Electronic Industries soon found itself without a major outlet for its product.

Then came General Dry Batteries' handy offer to set up a joint subsidiary to produce batteries in competition with Eveready. Within a year from start of operations sales soared to the ceiling of the plant's capacity and necessitated the present expansion.

Though Eveready is doing fine also, this firm's dependence on hard-currency Canadian acetylene black gives self-sufficient General Dry Battery an advantage.

India Plugs Superphosphate Use With Quota Setup

Bombay—Linking the offtake of superphosphates to ammonium sulphate fertilizers the Indian government has ruled that it will require states and provinces drawing the latter from the government to take phosphate as well—one ton of superphosphate for every three tons of sulphate.

Several Indian chemical works are producing superphosphate, chief among them being Fertilizers & Chemicals Travancore Ltd.

Brazil Plans Phosphate Unit at Santos

Rio de Janeiro—Serrana Sociedade Anonima de Mineracao, a Brazilian affiliate of Bunge and Born, is reported planning a new \$2-million phosphate fertilizer plant at Santos, state of São Paulo, to produce 50,000 tons per year, with an eventual capacity of 100,000 tons.

The phosphate would be acquired at deposits in the state of Minas Gerais, and the fertilizer would be sold at 700 cruzeiros (about \$35) per ton, roughly half the present price.

The state of São Paulo, coffee and cotton growing center of Brazil, now

consumes about 150,000 tons of fertilizer annually, part of it imported. This amount, however, fertilizes only about 8 percent of the state's cultivated land.

British Columbia Gets New Margarine Plant

Vancouver—Canada Packers Ltd. have commenced production of margarine at their plant at Vancouver. While the sale of margarine was legalized in Vancouver some time ago, its manufacture was not permitted in British Columbia until legislation to that effect was passed at the recent session of the B. C. legislature. Margarine went on sale in B. C. stores on April 18.

The butter substitute is being marketed by Canada Packers as Margene and the same plant will also produce Nucoa for Best Foods. While the margarine cannot be produced in butter tins under B. C. regulations, a small wafer of coloring ingredient is enclosed in each package and housewives can mix it into the margarine if they desire to secure the deeper butter coloring.

Murray Horton, manager of the margarine division of Canada Packers, stated that the launching of a margarine industry in Vancouver could mean the start of a new seed-growing industry in the province. Mr. Horton states his company would be anxious to buy locally produced vegetable oils.

According to L. N. Reynolds, manager of the Vancouver plant, Canada Packers was the first company in Canada to produce margarine.

Hairwaving Gives Australia Chemical Headache

Melbourne—The plight of many newcomers in Australia's chemical industry was epitomized in tariff board hearings on imports of thioglycolic acid. Once an obscure laboratory reagent, thioglycolic acid became an important trade item when it was discovered that ammonium thioglycolate was a useful ingredient in hairwaving solutions.

During World War II this use had become so important that the Australian cosmetic industry began to cry out for it. The Australian government refused to appropriate lend-lease dollars for its importation.

An enterprising Melbourne chemical laboratory with some experience in the synthesis of monochloroacetic acid and ammonium hydrosulphide offered to supply thioglycolic acid at \$11.50 per pound if somebody signed up a firm contract. A cosmetic laboratory contracted for the output, a plant was

set up, and production went under way shortly before the end of the war. Initial production costs were as high as \$25 a pound of 90 percent acid, but the firm swallowed the loss in the expectation of doing better with an improved plant set up after the war.

But after the war English firms started production of the chemical and offered a 95 percent acid at \$7.10, freight and container paid. These quotations spelled the end of the thioglycolic acid contract.

Investigations by the tariff board brought out the fact that production in England had been started more recently than in Australia and is conducted on a similarly small scale. The biggest cost item in both countries is the intermediate, monochloroacetic acid. In England, this compound is purchased by makers of thioglycolic acid and ammonium thioglycolate, but in Australia it is synthesized on the premises. The Australian firm pays for its involuntary self-sufficiency by producing monochloroacetic acid at more than twice its cost to English makers of the glycol compounds. Furthermore, the rate of recovery and other efficiency factors are much lower than in England, multiplying the higher cost of intermediate materials.

The Australian company sought protection for its plant investment behind a shelter of a 50 percent ad valorem minimum tariff, but it was not able to win the tariff board for the proposal. As a result, another unpayable Australian chemical industry will in all likelihood fold up.

Postscript: Imperial Chemical Industries is setting up a plant to produce thioglycolic acid in Australia. I. C. I. will probably synthesize the compound from imported monochloroacetic acid.

South Africa Expanding Water-Gas Output

London—Three more water-gas units are being built as part of the \$8-million South African nitrogen fertilizer plant. The new African Explosives & Chemical Industries (Pty.) Ltd. units are being supplied by the Power Gas Corp. Ltd.

Power-Gas installed the first two water-gas units for the South African company in 1930. An additional unit was added in 1935 and a contract was awarded for a fourth unit in 1947. Before this unit was completed, however, an order was received for another plant of three units, bringing the total projected installations at two of the works of this South African firm to seven units.

It is believed that, when the South
(Continued)

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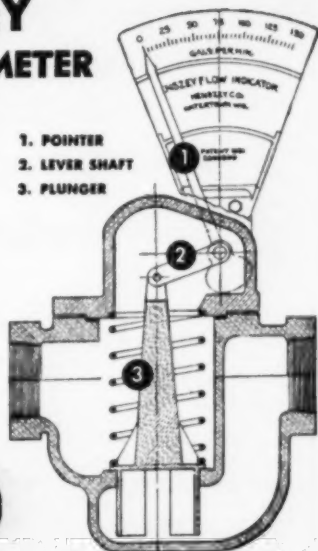
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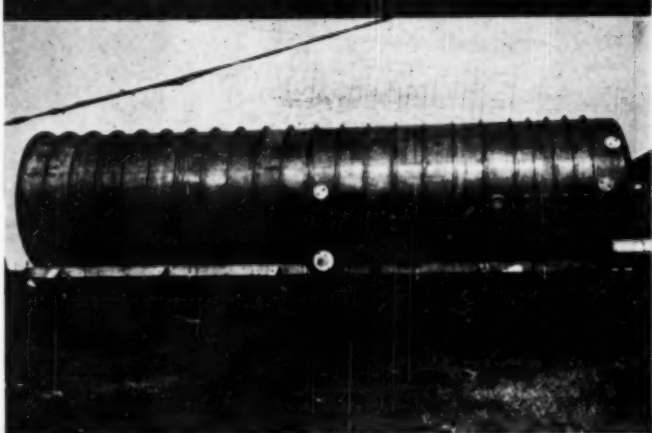
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FOREIGN NEWS, CONT.

African project is completed, output of ammonia from extensions to the Modderfontein Works will reach 26,000 short tons per year. Together with existing capacity, this is expected to make the Union self-supporting for fixed nitrogen.

Australia Paper Mill Gets Black Liquor Byproducts

Melbourne—Australia Paper Manufacturers Ltd., Maryvale, Victoria, has installed a furnace plant to burn the black liquor from the sulphate pulp (kraft) mill. At the same time the unit recovers chemicals from the ash and flue gases.

Black liquor is concentrated from 16 percent solids to 60 percent in a vertical film type evaporator, and sodium sulphate is added to the concentrate before it is fed into the furnace.

The 60 parts solid consist of 22.2 parts, C, 2.7 parts H, 8.1 parts of other matter and 27 parts of recoverable ash. The gross calorific value of the fuel is 3,900 Btu. per lb.

The liquor is sprayed onto the walls of a Tomlinson recovery furnace. This is started with an oil burner but requires no extraneous fuel after the cycle is in full swing. The water is evaporated from the liquor and the solid residue drops to the bottom and provides the fuel for a Babcock & Wilcox waste heat boiler.

The sodium sulphate, heated in the presence of carbon, is reduced to sodium sulphide, and this is recovered from the ash along with sodium carbonate. The mixture is drawn off the furnace bottom and dissolved to form a green liquor. This is treated in the causticizing plant and recirculated into the digesting vats. Before the fumes from the furnace pass into the atmosphere they are stripped of sodium sulphate and is this is also recovered.

Oversupply Forces Indian Soda Ash Unit to Close

Bombay—Oversupply and resistance to high prices has brought the shutdown of India's largest producer of soda ash, the 36,000 metric ton a year Tata Chemicals Ltd. works at Mithapur in Baroda State. More than 3,000 workers at the remote factory on the shores of the Arabian Ocean were laid off.

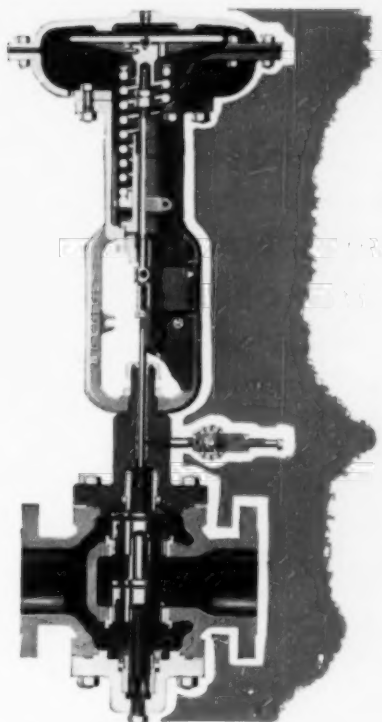
Although the plant never has operated near capacity it was the biggest contributor to India's internal production of some 30,000 metric tons annually.

The soda ash supply situation has
(Continued)

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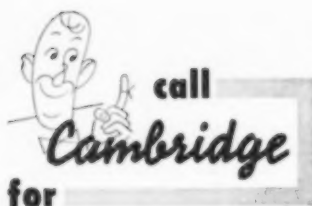
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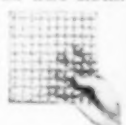


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FOREIGN NEWS, cont. . .

cased so much this year that imports from hard currency areas have been

banned completely and imports from soft currency countries have been removed from the "free" list and subjected to strict licensing.

British Industries Fair Shows Chemical Industry's Latest Wares

London—Chemical industry was one of the prominent groups at this year's British Industries Fair. Chemical manufacturers do not depend on trade exhibitions for obtaining new orders to the same extent as other industries, but the B.I.F. provided an excellent opportunity for a survey of the present position of Britain's chemical trades. Compared with last year's fair the visitor's chief impression was that all chemical staple commodities are in better supply. Some shortages continue. Decontrolling of a number of raw materials has not led to a general expansion of offerings of chemicals made from them, but the supply of most established products has improved. Delivery terms are much shorter this year.

In contrast, manufacturers intent on bringing out new products are still faced with irritating delays in the receipt of plant and equipment. The government, as a matter of policy, in

sisted on priority for plant extensions to be given to old products needed in larger quantities, even though this inevitably prolonged the delays experienced in bringing new products to the commercial stage of development. The number of new chemical and pharmaceutical products shown at the B.I.F. this year as available in commercial quantities is therefore comparatively small, while, on the other hand, quite a number of firms mentioned experimental work now in progress on new products, largely with a view to testing the prospective market for them.

British Industrial Solvents Ltd., for instance, showed only two novelties this year, isopropyl acetate (which had not been produced in Great Britain before) and methyl ethyl ketone sebacates, but gave a long list of new products which may be brought out in the next 18 to 24 months. The list

(Continued)

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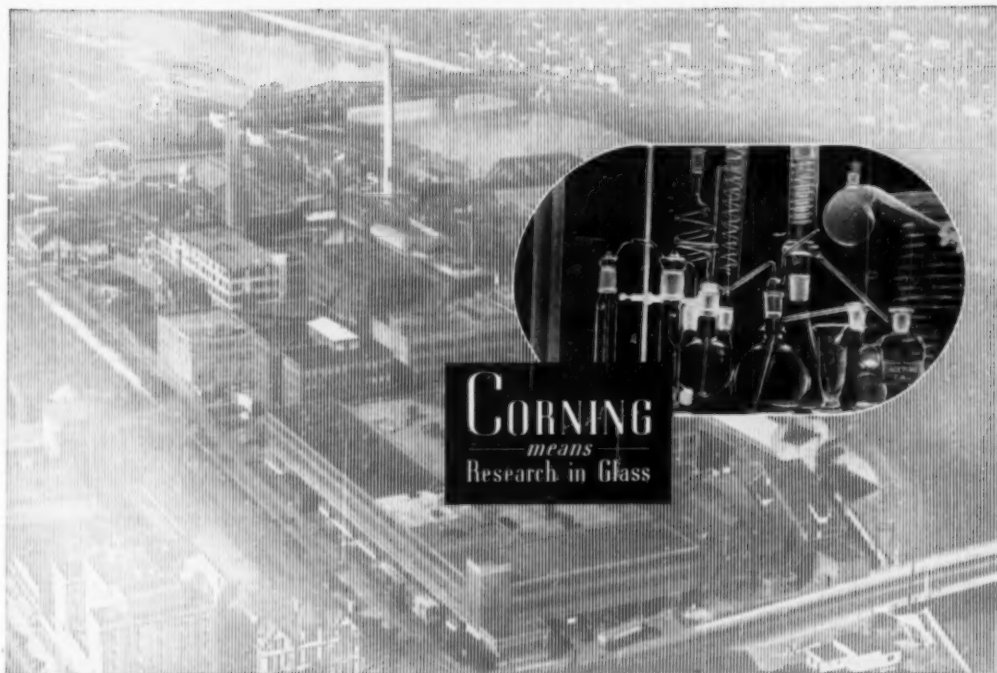
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This close association is characteristic of our relationships with many leaders of American industry, especially in the processing, chemical, and related fields. In fact, most of our business for years has been repeat business from satisfied customers who like the Ferguson method of working under one contract, one responsibility, and one profit. Some clients retain us on a continuing basis to handle all of their engineering and construction problems as they arise.

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OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA

FOREIGN NEWS, CONT.

includes acetoacet-o-toluidide, acetyl acetone, butylene glycol, butyl laurate, *n* butyric acid, di-(secondary butyl) phthalate, di-cyclohexyl sebacate, di-decyl phthalate, diethyl sebacate, di-methoxy butyl phthalate, dimethyl cyclohexyl phthalate, dinonyl sebacate, ethyl hexanoic acid, ethyl propyl acrolein, hexylene glycol, mesityl oxide oxalic ester, methoxy butanol, methoxy butyl acetate, methoxy ethyl stearate, methyl acetoacetate, methyl isobutyl carbinol, octylene glycol, phenyl methyl pyrazolone, and tributyl borate. Of these it is proposed to produce hexylene glycol before the end of 1950. For the rest, the company's decision will depend on the interest shown for the various products.

Few chemical manufacturers went so far as to give a detailed list of products they intend to bring into commercial production this year and next. Of pharmaceutical producers Boots Pure Drug Co. Ltd. this year for the first time offered di-isopropyl fluorophosphonate, di-(2-chloroethyl) methylamine hydrochloride, and British anti-Lewisite (developed during the war against poison gases and now offered chiefly for the treatment of arsenic, mercury and gold poisoning). This and other producers offered a number of new penicillins. The Distillers Co. (Biochemicals) Ltd. displayed a form of penicillin for which prolonged action, in suitable suspension, is claimed, with the result that an effective level in the bloodstream is maintained as long as 36 hrs.

Pharmaceutical manufacturers, perhaps more than other chemical producers, are now feeling the impact of sterling scarcity abroad on their exports. This may explain why some of them seem to be attaching special importance to extending their interests in neighboring fields. May & Baker Ltd. showed a wartime fire extinguishing component (methyl bromide) which has now been adopted as a fumigator of seeds for the East African groundnut scheme. This firm also displayed a selective weed killer, Dicox, described as a hormone treatment for the garden which kills weeds and allows grass to grow undisturbed.

A. Roake, Roberts & Co. Ltd. showed potassium glycine, recommended for the removal of hydrogen sulphide and carbon dioxide from hydrocarbon gases instead of the German Alkacid products which were used for this purpose before the war. The firm also displayed, among new products, anti-foaming agents, metallic ethylhexoates, glyceryl mono-cresyl ether.

(Continued)

VESSEL DIVISION

NEWS



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Corporation

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Tulsa 3 • Dallas 1 • Houston 2 • Seattle 1 • Los Angeles 14
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VESSEL LIFE INSURANCE. Before this SMITH-lined Paper Mill Digester was manufactured, an extensive and comprehensive testing program was completed to be sure the proper alloy lining was selected for the corrosive service. An experimental digester was built and a great many "cooks" were run before the final decision was made.



USING SMITHway MULTI-LAYER CONSTRUCTION WAS MORE ECONOMICAL than single-plate construction in the manufacture of this 72 in. dia. by 80 ft. long water scrubber, at the same time providing a safer construction.



CONSISTENT QUALITY OF SMITHway ELECTRODES used in the manufacture of SMITHway Pressure Vessels is preserved by meticulous control procedures. By means of this X-ray diffraction machine, all raw materials used in electrode coating are checked for the presence of any foreign materials or impurities.

FIELD ASSEMBLY COSTS CUT TO A MINIMUM. The SMITHway is to do the maximum amount of work possible in the shop on vessels too big to be shipped in one piece. All the shell courses on this 15 ft. dia. by 113 ft. long SMITHway Atmospheric Tower were tacked together in the shop to get more accurate and complete installation of the internals.

SEND FOR THESE NEW BULLETINS

Write the nearest A. O. Smith office (see list at top of page) for these newest Vessel Bulletins:

FIELD ASSEMBLY OF PRESSURE VESSELS—Bulletin V-44.

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Looking for a valve that *won't leak*



even in severe corrosive services?

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The diaphragm also serves as a seal to prevent external leakage and makes it impossible for the material handled to be contaminated or for the material to get into the working parts. You can't beat it for simplicity and effectiveness.

Hills-McCanna Diaphragm Valves are made in standard sizes $\frac{3}{8}$ " through 14". Available with rubber, glass or specially lined bodies or with cast iron, alloy, Hareg or stone ware bodies. Choice of manual, remote or automatic controls. Write for data sheets. HILLS-McCANNA CO., 2341 W. Nelson St., Chicago 18, Illinois.

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diaphragm valves

Also manufacturers of — Proportioning Pumps

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FOREIGN NEWS, CONT. . .

di-nonyl phthalate, tetra-hydro fur-furyl oleate, lithium stearate, aluminum stearate pharmaceutical-grade, and isopropyl myristate. The company further has under development a number of ethylhexyl compounds.

The fair also gave evidence of the efforts made by British manufacturers to replace products which were formerly imported. Several firms have extended their range of dyestuffs, though nothing fundamentally new was seen in this field. A Yorkshire dyestuffs firm, L. B. Holliday & Co. Ltd., showed a new "optical bleaching agent" which has affinity for all fibers but is claimed to be especially effective on animal fibers; applied in conjunction with dyestuffs, it is stated to give purer and brighter shades. Monsanto Chemicals Ltd. drew attention to chemical additives for lubricating oils, phenolic adhesives for plywood, and synthetic detergents.

PETROCHEMICAL DISPLAY

The petrochemical industry was represented by very impressive displays of the outlay of new plants, but the number of new products available from these plants is as yet small. Petrochemicals Ltd. is now producing benzene, toluene, xylene, aromatic solvents and plasticizers, and pitch by its catarole process, and anticipates that bulk supplies will be available by the fall of 1949 of isopropyl alcohol, isopropyl ether, ethylene oxide, ethylene glycol, naphthalene, hydrocarbon resins, and para-tertiary butyl phenol. By the end of the year it expects to produce polycyclic aromatics, propylene derivatives, acetone, and ethylene dichloride.

Perhaps the most important stand from the chemical point of view at the B.I.F. was that of the Ministry of Supply which announced that supplies of radioisotopes are now available in sufficient quantities. They are available as irradiated units, as chemically separated isotopes, and as special irradiations of users' own materials or specimens. Some are available for export, though apparently only to institutions and governments of foreign countries which agree to publish the results of the research carried out with the isotopes. The prices of British artificial radioactive materials are said to be comparable with those charged by the U. S. Atomic Energy Commission. Price adjustments were recently made to give some relief from the large initial "handling" charge to the research worker requiring less than five millicuries.

One of the most important objects
(Continued)

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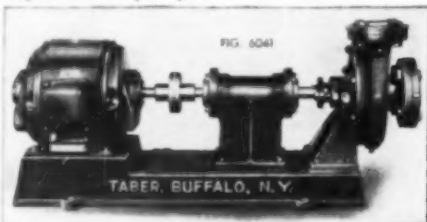
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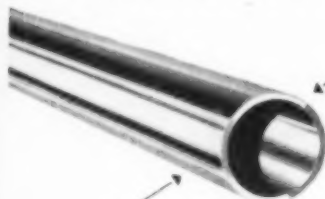
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FOREIGN NEWS, cont. . .

of the Ministry of Supply's atomic energy program as regards artificial radioactive material is to meet the needs for tracers. Ministry of Supply has also undertaken to provide natural radioactive substances, such as radium and radon, for medical use and research. The medical demand is now being met in full, and radon sources are becoming available for industrial use. Among the lesser known radioactive elements which occur in nature associated with uranium or thorium, the following isotopes, useful for research purposes, are said to be available: radium D and polonium, the "technical" grade of mesothorium, and radiothorium. The following compounds containing C-14 have been synthesized by the Radiochemical Centre at Amersham and will shortly be available to all users: methyl alcohol, acetic acid (carboxyl labelled), acetic acid (methyl labelled), methyl iodide, and bromoacetic acid (methylene labelled).

Canada Continues Tar-Sand Extraction in Alberta

Ottawa—Renewal of the lease on 3,840 acres of the tar-sand shores of the Athabasca River to Abasand Oils Ltd. is reported in Canada. The company conducted many tests before and during the war on the extraction of oil and bitumen from these sands in the Alberta area. During the war the company was partially financed by the federal government.

Tests were halted when fire destroyed the company's test plant. Under the terms of the lease now issued the company is required to process 100,000 tons of tar-sands in each of the years 1955, 1956, and 1957 or lose the lease. By 1960 the lease calls for treatment of 200,000 tons of sand annually. The company is required to pay a royalty of 10 percent on every barrel of oil. The lease lies on the Athabasca River between Waterways and the provincial government's test plant at Bitumont.

Money Problems Fail to Stop Indian Aluminum Plans

Bombay—Undismayed by the failure of finance to come forward in support of the National Aluminum Co. of India, despite assurances of provincial government support, the Central Provinces government is making plans to go ahead with the project entirely on its own. P. S. Sharmagani, provincial chief engineer, has been sent to Britain and Switzerland to report on the planning of the plant. —End

five

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concentration of
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separation of
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from each other

substitution of
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1 A "Karbate" flexible coupling ready for assembly. Note rubber gasket covering serrations on right hand pipe, $\frac{1}{4}$ " from end. Gasket lying on table will be similarly applied over serrations on left hand pipe.



2 Flexible coupling being tightened in place.

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3 "Karbate" pipe being joined to gas inlet of a "Karbate" absorption tower by means of strong "Type V" flanged connection. Note flat place on bolt in foreground. This provides purchase for the second wrench to assure tightness in joint.

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The Corrosion Forum

EDMOND C. FETTER, Assistant Editor

Fatty Acids versus Construction Materials

Part III of a symposium in which a representative group of construction materials are evaluated for services involving fatty acids.

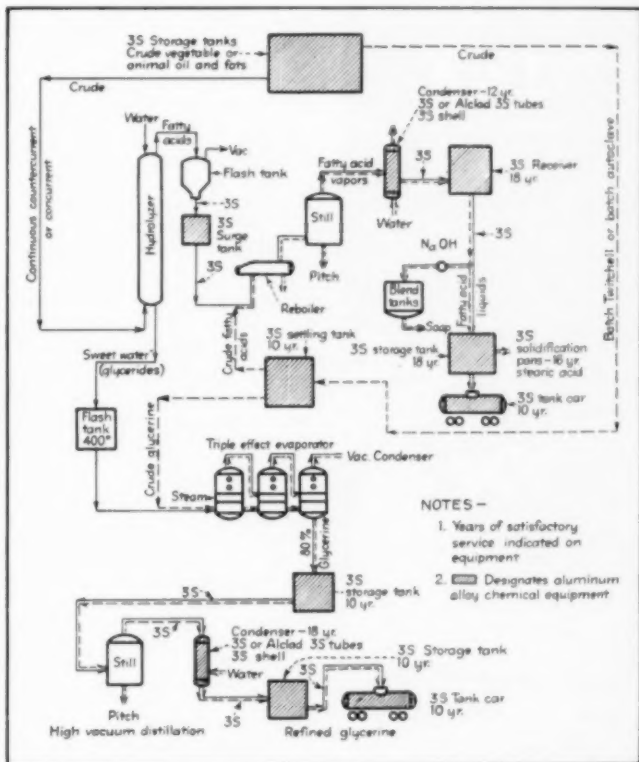
High-Silicon Irons

WALTER A. LUCE, The Duriron Co., Dayton, Ohio

The high-silicon iron, Duriron, shows excellent corrosion resistance to the various fatty acids even at temperatures approaching 600 deg. F. It also exhibits high resistance when sulphuric acid is present as in the esterification of fatty acids. However, the susceptibility of Duriron to thermal and mechanical shock has limited its use in fatty acid services especially since the conventional stainless steels, the high alloy stainless steels, aluminum and others also exhibit high resistance to these acids. The high temperature conditions encountered in these services usually do not justify the use of an alloy having limited mechanical properties particularly since Duriron does not provide superior corrosion resistance in this instance. Nevertheless, Duriron equipment has found application where fatty acids are encountered. For instance, one large chemical company uses Duriron pumps for handling stearic acid during the manufacture of zinc and aluminum stearates. Over three years' experience is being received with no apparent corrosion as detected by visual examination. Similar reports are being received concerning Duriron valves in various fatty acid services. Duriron equipment is also used in handling sulphuric acid which is used in conjunction with the fatty acids.

Duriron has a nominal chemical composition of 14.5 Si, 0.75 Mn and 0.90 C max. Although it is produced in the cast form only, a wide range of chemical equipment is available. Typical equipment includes centrifugal pumps, valves, pipe and fittings, fans, ejectors, heat exchangers, heaters, jets, mixing nozzles, kettles and others.

The high-silicon iron, Durichlor, which contains 3 percent molybdenum



A composite, showing where aluminum is used in various fatty acid processes.

in addition to the standard Duriron analysis, has no advantage in corrosion resistance over Duriron for fatty acid services. Durichlor is especially recommended for hydrochloric acid, chlorine and for most corrosive chlorides.

Aluminum

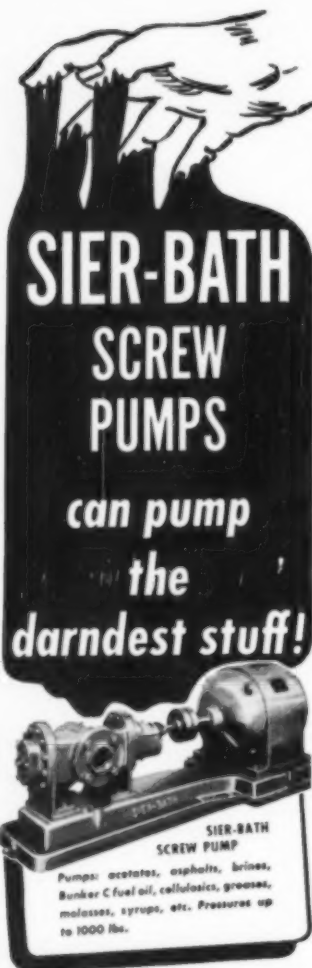
ELLIS D. VERINK, JR., Aluminum Co. of America, New Kensington, Pa.

One of the important applications of aluminum chemical equipment has been its use for condensing, conveying, storing, and handling of saturated or-

ganic mono-basic acids. These acids belong to a homologous series called the fatty acid series, so named because many of them occur in combination with glycerol as fats. Aluminum is used, not only for these acids, but for their derivatives and for fats. In some cases, satisfactory service records of over 18 yr. are not unusual in all these services at temperatures as high as 450 deg. F.

Aluminum is especially suited for service with fats and oils (1) because it has no pro-oxidant effects on the materials handled, and (2) because color and quality may be maintained.

At storage temperatures, no attack (Continued)



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Pumps: acetates, asphalts, brines,
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CORROSION FORUM, cont. . .

is observed from uncontaminated fatty acids—from acetic acid on through the higher acids such as stearic and oleic. The presence of heavy metals and chlorides may stimulate attack under certain conditions. At boiling temperatures, uncontaminated fatty acids do not attack aluminum, provided at least the slightest trace of moisture is present at the metal surface.

The composite flow chart (p. 243) shows diagrammatically where aluminum has proved its usefulness through years of satisfactory commercial service. The length of service to date is indicated on the flow chart. For example, aluminum condensers are still in service after 18 years handling vapors of stearic, oleic, and myristic acids at temperatures near 450 deg. F. in the presence of steam. Where extreme purity and freedom from contamination are essential, such as for the transportation of highly refined fatty acids and glycerine, aluminum tank cars are selected. Aside from the applications shown on the attached flow chart, aluminum is finding wide application in the solvent extraction processes which are currently being applied to the refining of soybean oils. As in previous processes, the fact that the product is not contaminated or discolored by contact with aluminum is important.

The alloys normally recommended for service with fats and fatty acids are: 2S, 3S and 52S for vessels; 3S and 63S for piping; 3S and Alclad 3S for heat exchanger tubes; 3S, 52S and 61S for shipping containers; and for castings, 43, B214 and 356.

REPRINTS

Conclusion next month of the symposium, *Fatty Acids versus Construction Materials*, will bring to twelve the number of articles and symposiums that have appeared in this series. Each is available as a reprint from Editorial Dept., Chemical Engineering, 330 W. 42nd St., New York 18, N. Y. Prices are as follows:

Phosphoric acid	25c.
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DURIRON is highly resistant to the corrosive attack of all commonly used acids except hydrofluoric, sulfurous and oleum.

DURICHLOR is similar to Duriron but it has special resistance to hydrochloric acid and its compounds.

DURIMET 20 is a patented low carbon, high alloy, stainless steel. Durimet 20 fans will safely handle the fumes of oleum, sulfurous

or sulfuric acid, sulfur dioxide and hydrofluoric acid.

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Complete drainage of corrosive condensate.

Motor can be removed without disturbing fan connections.

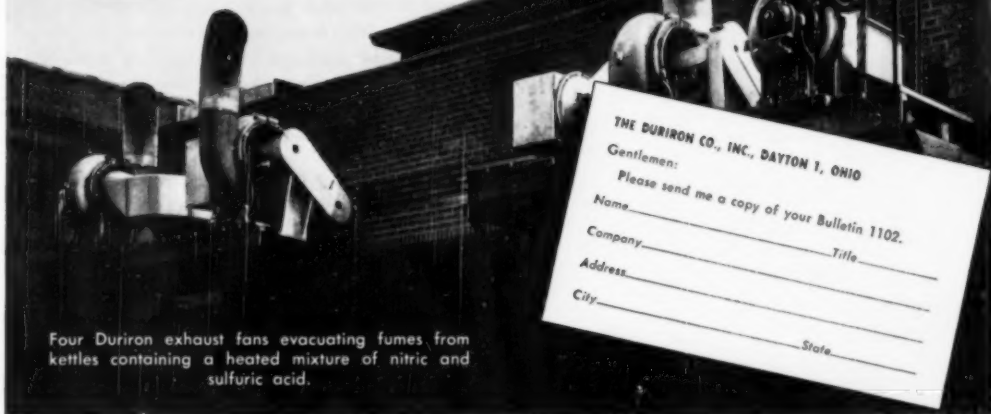
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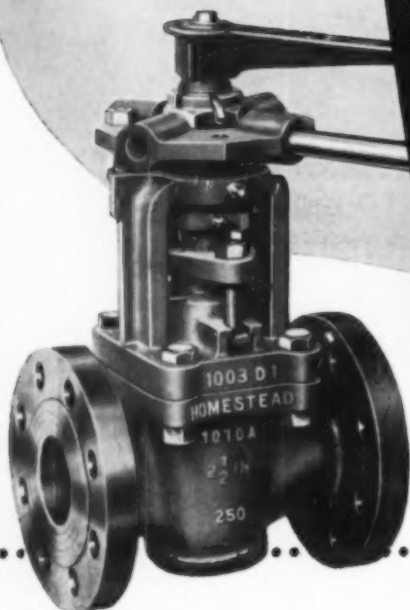
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- Unobstructed straight-line fluid flow.
- All operating parts protected from damaging effects of service conditions and weather.

For 16 years, they have been first choice for difficult services where extremes of temperature or pressure or corrosive line fluids cause ordinary valves to "stick" or "seize." Due to their exclusive "Lever-Seald" construction, they render instant, Stick-Proof service. They operate fast, too . . . full open or close in a quarter-turn . . . 16 to 28 times faster than screw-stem-type valves. And because all operating parts are protected from the damaging effects of line fluids, service conditions and weather, long life, low maintenance and trouble-free service are assured.

HOMESTEAD LEVER-SEALD VALVES are made in metals and alloys to meet service requirements; sizes 1½" to 12"; for pressures from vacuum to 1500 pounds.



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Names in the News



MAN OF THE MONTH

J. J. Schommer

John J. Schommer, one of the greatest all-round athletes in the history of American sport and a prominent football official for many years, has announced that he will retire as athletic director and director of placement at Illinois Institute of Technology, effective September 1.

The 65-year-old Schommer has been Illinois Tech's athletic director since 1913. As head of the Institute's placement office, he has helped numerous Illinois Tech alumni obtain positions in business and industry.

He is also professor of industrial chemistry and remained active in that capacity until September 1948. He is a member of the Institute's board of trustees.

John Schommer compiled a brilliant scholastic record at Chicago. He was named to Owl and Serpent and was chosen University Marshall, the highest honor the administration bestows upon an undergraduate.

After a year and a half of graduate work in chemistry and bacteriology at Chicago, he entered Illinois Tech (then Armour Tech) and in 1912 received a bachelor's degree in chemical engineering. The following year he assumed the duties of director of athletics.

For many years he was director, and later owner, of the Acme Plating Co. of Chicago. He also did considerable commercial work for industrial firms.

As a college athlete he performed in the "Golden Era" of sports at the University of Chicago and became the first person in the history of that school to win 12 letters. He was outstanding in each of four sports—basketball, football, baseball and track.

During World War II, Mr. Schommer was assistant to the state selective service advisor on occupational deferments. He has been a member of the Cook County Highway Authority and is now chairman of the Illinois State Superhighway Commission.

For eight years he was president of Illinois Tech's Alumni Association and he has also headed the Chicago Club of the University of Chicago Alumni Association. He has been president of the University of Chicago's varsity lettermen "C" club.

He is a member of the following clubs and societies: American Institute of Chemical Engineers, American Chemical Society, Society for the Advancement of Science (fellow), Society for the Promotion of Engineering Education, Society of Illinois Bacteriologists, Chemists' Club of Chicago, Dairymen's Country Club, the University Club of Chicago, and Tau Beta Pi, honorary scholastic engineering society.

He has received a number of awards, including the Illinois Tech Alumni Award of Merit, the University of Chicago Citation for Public Service, the Armour Research Foundation of Illinois Institute of Technology, recognition award for outstanding contribution in the field of scientific and engineering research and education, and a medal from Congress for his selective service work.

After his retirement Schommer intends to devote his time to the \$15,000,000 development and modernization program which is designed to give Illinois Tech the "world's most modern college campus."

William C. Keeley has been elected executive vice president of U. S. Industrial Chemicals, Inc.



G. B. Beitzel



W. F. Mitchell

George B. Beitzel has been elected president of Pennsylvania Salt Manufacturing Co. Leonard T. Beale, president for the last 20 years, will continue with the company as chairman of the board. At its annual meeting the board also elected William F. Mitchell vice president in charge of manufacturing and William P. Drake vice president in charge of sales. Mr. Drake assumes the position left vacant when Mr.

Beitzel became executive vice president. Mr. Mitchell succeeds Y. F. Hardcastle, who has retired from active participation in the chemical company's operation but who remains as a member of the board.

Robert Hinton, who has played a large part in focusing attention of the chemical industries on the Ash-tabula-Painesville area in his capacity of manager of industrial sales, has moved up to manager of sales for Cleveland Electric Illuminating Co.

Richard Van Vyve has been placed in charge of a new customer's service laboratory inaugurated by the Hilton-Davis Chemical Co., Cincinnati, to cooperate on the control, standardization and development of pigments, dyes, varnishes and related products.

Richard R. Memer has joined the Jackson Laboratory of the Du Pont company, Deepwater Point, N. J.

He was assigned to the intermediates division.

S. C. Ogburn, Jr., who last year joined Foote Mineral Co. of Philadelphia as manager of research and development, has been appointed a director of that firm.



S. C. Ogburn, Jr.



C. M. Marberg

Carl M. Marberg, for the past two years coordinator of research planning for Standard Oil Co. of Indiana, has joined the research staff of Gustin-Bacon Manufacturing Co. at Kansas City. Marion W. Phillips, (Continued)

TANK LININGS

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RESILON
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As a fabricator of corrosion-resistant equipment from plastics, rubber, ceramics and metals, we can recommend without prejudice the most effective material for your specific application, and at the lowest cost.

Have you tried Tygon Plastic Paint to protect plant equipment against corrosive fumes? Try it. You'll save time, money and worry.

Write for the "U. S." chemical stone-ware catalog showing hundreds of standard and special items, such as, tanks, pots, crocks, valves, pipe, fittings, tourills, acid eggs, kjeldal equipment, pumps, coils, etc.



NAMES IN THE NEWS, cont. . .

formerly of the Midwest Research Institute, has been named supervisor of a new pilot plant set up by Gustin-Bacon in connection with its fibrous glass products development.

Kenneth Hoover, vice president, research, has resigned from Commercial Solvents Corp., Terre Haute.

Carl Bauer has been named manager of industrial sales and **W. E. Santoro** is director of laboratories of Standard Varnish Works of New York.

J. R. Carringer, vice president and assistant to the president of Esso Standard Oil Co., retired last month after 45 years with the company.

Carroll A. Hochwalt, vice president and coordinator of research and development activities of the Monsanto Chemical Co. at Dayton will move to St. Louis in September. He has been named head of a new company being formed by Monsanto and American Viscose Corp. to engage in research and development work in the field of synthetic fibers. **Howard K. Nason** will succeed Dr. Hochwalt in Dayton.

Frank B. Kreider has been appointed the eastern and midwestern regional manager of Pabco's insulation division with headquarters at the Paraffine Co.'s offices in New York.

J. C. Warner, dean of graduate studies and head of the chemistry department at Carnegie Institute of Technology, has been elected vice president and a member of the board of directors of the Electrochemical Society.

Kenneth W. Bayha has been transferred by Commercial Solvents Corp. from Terre Haute to the company's San Francisco office. Mr. Bayha will do technical service work on the West Coast.

Raleigh Gilchrist has been appointed chief of the platinum metals and pure substances laboratory of the National Bureau of Standards.

James C. Stewart, project engineer for the Oak Ridge National Laboratory, Oak Ridge, Tenn., has been appointed to succeed **Leonard E. Johnston** as manager of the U. S. Atomic Energy Commission's area office at Schenectady, N. Y. Stewart will represent the AEC in the management of the Knolls Atomic Power

Laboratory, operated for the commission by the General Electric Co. Mr. Johnston has been named manager of the commission's new reactor test station.

John B. Trotter, assistant branch manager for Monsanto Chemical Co., Charlotte, N. C., has been appointed assistant general branch manager at Birmingham, Ala. A native of Birmingham, he has been with Monsanto in Charlotte since 1939.

Edmond W. Camp, who plans to retire this summer as head of the department of textile engineering at Alabama Polytechnic Institute, Auburn, Ala., will devote his time to chemical research.

Max H. Thornton has been appointed chairman of the chemical research division at Midwest Research Institute, Kansas City, Mo.

Victor Conquest, director of chemical research and development department, Armour and Co., has been given charge of all scientific research and development activities of all divisions of the company including Armour Fertilizer Works, Armour Leather Co. and all domestic and foreign subsidiaries and affiliates.

Harry L. Fisher, director of organic research of U. S. Industrial Chemicals, was awarded the Charles Good-year Medal for outstanding achievement in rubber chemistry by the American Chemical Society's division of rubber chemistry in Boston last month.

Ray P. Rossman, formerly manager of the southwestern rubber testing laboratories for Cabot Carbon Co., has been assigned to the technical service staff of Godfrey L. Cabot, Inc. He will continue to maintain his residence in Pampa, Tex.

C. F. Bonnet has been named production manager of the industrial chemical division of the American Cyanamid Co. **G. W. Russell** is assistant sales manager.

Llewellyn S. Howe has been appointed director of engineering at the Glenn L. Martin Co.'s chemical division at Painesville, Ohio.

C. H. Madsen has been named plant manager of the synthetic rubber plant operated by United States Rubber Co. at Borger, Tex. Mr. Madsen was formerly plant manager for Canadian Synthetic Rubber. (Continued)

automatic compensation

FOR PRESSURE OR TEMPERATURE OR BOTH

with
HAGAN
RING BALANCE
FLOW METERS

When gas pressure departs from that for which the orifice was calculated, readings of conventional flow meters require the application of a "correction factor".

In Hagan Ring Balance pressure compensated flow meters, correction is automatic. The chart reading is the compensated reading, although both compensated and uncompensated records on the same chart can be obtained if desired.

This meter can also be supplied for temperature compensation, either alone or in combination with pressure compensation, and a temperature record may be added to the chart. In fact, a total of four records can be made on a single chart.

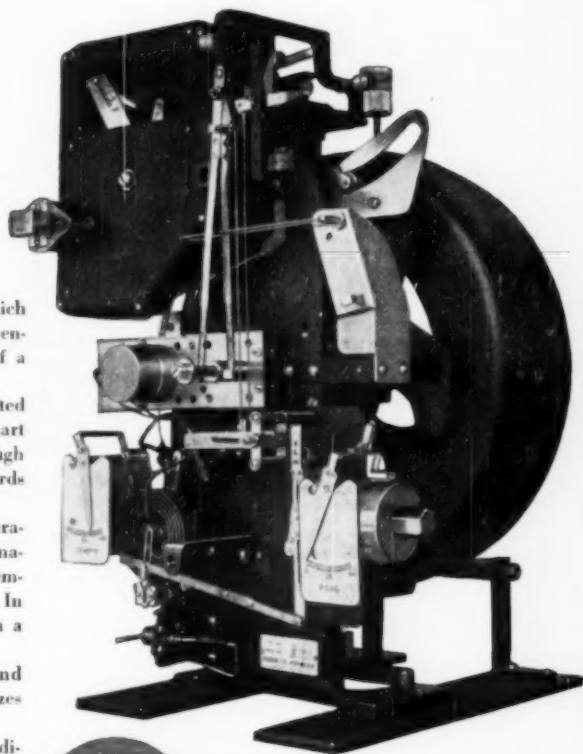
An integrator, operative between 2% and 100% of chart reading, automatically totalizes the compensated flow.

The Ring Balance principle makes the addition of pressure and/or temperature compensation so simple that it is a standard model in the Hagan Ring Balance line—not a special "problem child".

Measurement of gas flow is only one application of these extremely versatile meters. For full information on Hagan Ring Balance Meters or on specific metering problems write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

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RING BALANCE FLOW AND PRESSURE INSTRUMENTS
THRU-ROCK FORCE MEASURING DEVICES
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Pressure and temperature compensated Hagan Ring Balance Meter of the low pressure, low differential type. Differential may be as low as one inch of water.

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Ring Balance Meter Division
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Please send me further information on pressure and temperature compensated Hagan Ring Balance Meters.

NAME

STREET

CITY STATE CE-6

LOOK WHAT'S HAPPENING on the Texas Coast

ASBESTOS CO. ADDS SILICA MILL

Construction has just been completed in Houston on a \$125,000 unit for the Asbestos Company of Texas to manufacture ground silica sand. Test runs have been completed, and production has now reached a daily output of 75 tons or one and a half carloads. About half the production will be absorbed by the company itself in the manufacture of its Mustang Brand shingles and siding. The balance will go to foundries, paint manufacturers.

FAMOUS NAME MOVES TO ROBSTOWN

Under the name of Agricultural Chemicals, the Sherwin Williams Company has recently started operation of a new blending plant at Robstown. Located on a 5-acre tract, the new plant is turning out about 12,000 lbs. of cotton and vegetable insecticides daily.

TALL TALE... BUT TRUE

On many Texas ranches you can ride from sun-up to sun-down without getting from the front gate to the back. Those are just the medium sized ranches. Some of them really get big, like the ranch of the late W. T. Waggoner, reputed to have been the richest man West of the Mississippi in his day. This story proves the point. Two farmers were talking when one of them mentioned a certain county. "Where's that?" asked the second farmer. "Oh," answered the first nonchalantly, "It's one of the counties on Tom Waggoner's ranch."

A CHEMICAL EMPIRE A-BUILDING

That's the Texas Gulf Coast. Check the names that have established here: Dow, Monsanto, Shell, duPont, Carbide and Carbon Chemicals, to name a very few. Check the products made here: heavy, industrial chemicals; synthetic rubber; alcohol; glycerine; solvents; fertilizers and plastics, to start the list. Check the advantages this region offers you unlimited quantities of acids, bases, sulphur and fresh water, AND NATURAL GAS for hydro-carbons; good reasons why your industry can profitably FOLLOW THE TREND TO TEXAS.

To help you find out more about the area we serve, we will gladly: (a) make a survey engineered to your company's needs; (b) supply you with any special information you require; (c) show you the coast country from Orange to Corpus Christi—all in strictest confidence. Write, wire or telephone Houston Pipe Line Company, Houston, Texas.

HOUSTON PIPE LINE CO.
Subsidiary of Houston Oil Company of Texas
6000 N. 10th St. Houston, Texas
Wholesalers of **Natural GAS**

NAMES IN THE NEWS, cont. . .

ber Co., Ltd., Sarnia, Ontario. He succeeds G. A. Graham, who has been transferred to U. S. Rubber's New York office.

W. A. Bain, since 1947 assistant to the technical director of the Kellogg Corp., subsidiary of the M. W. Kellogg Co., has been promoted to the post of director of chemical research of that company.



W. A. Bain



B. Wilcoxon

Benton Wilcoxon has been appointed general manager of the John Powell Chemical Co., Huntsville, Ala., a recently-formed subsidiary of John Powell & Co., Inc., New York. Prior to his appointment by Powell, Mr. Wilcoxon was production manager of Alabama Chemical Co. Mr. Wilcoxon will head up operations of Powell's new 60,000-sq. ft. insecticide plant in Huntsville.

Vannevar Bush, who was chairman of the Office of Scientific Research and Development during World War II, received the 1949 medal of the Industrial Research Institute May 2.

L. S. Fryer, formerly production vice president of Industrial Rayon Corp., has joined Native Laces & Textiles, New York, as vice president and member of the board of directors.

Matlin F. Leffler, formerly head of the organic research department at Abbott Laboratories, has been appointed assistant director of research. Marvin A. Spielman, formerly a group leader in organic research, succeeds Dr. Leffler as head of the organic research department. Arthur W. Weston has been appointed assistant head.

Austin M. Patterson of Xenia, Ohio, retired vice president of Antioch College has received the new Award in the Documentation of Chemistry, sponsored by the Dayton section of the American Chemical Society. The award, a hand-engraved scroll testifying to Dr. Patterson's half century of service, was pre-

(Continued)



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and Time by using
DARNELL Casters
and Wheels... Al-
ways dependable,
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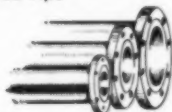
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FIRSTS"**

made by

"WAKEFIELD AMALGAMATED"
lead-lined
IRON PIPE COMPANY



FIRST — Expanded Lead Lined Pipe



FIRST — Homogeneous Lead Lined Pipe



FIRST — Lead Lined Flanged Fittings



FIRST — Lead Lined Valves



FIRST — Lead Lined Soil Pipe and Fittings



FIRST — Homogeneous Lead Covered Equipment

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One of the most valuable assets in arriving at the correct answer to problems involving Lead Lined Equipment is our long EXPERIENCE AND "KNOW-HOW" in this field.

Established in 1890, this Company is the oldest manufacturer of this type of equipment in the field today.

No matter what the corrosive problem presented by chemicals, gases, high temperatures, pressures or vacuum, our Engineering Department is ready to make recommendations without obligation on your part.

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LEAD LINED IRON PIPE CO.

WAKEFIELD, MASSACHUSETTS

ESTABLISHED 1890

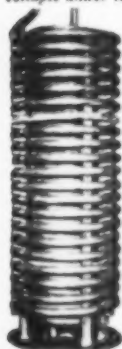
New THE BEST COILS for Heating and Cooling H_2SO_4 are **KNAPP PROCESS** HOMOGENEOUS Pb COVERED COPPER COILS

FOR the first time such coils are available with all of these features: Low cost! High corrosion resistance! Excellent heat transfer! High physical strength! Fabricating economy! Simplicity of repair! Excellent fatigue resistance!

HOMOGENEOUS Lead Covered copper coils improve on the performance of other mediums (when used to heat or cool H_2SO_4 and solutions).

1 Compared with the hard metals: Better corrosion resistance! Better heat transfer! Lower initial cost! Longer life!

2 Compared with lead pipe coils: Better heat transfer! Lower initial cost (or great improvement in heating cycle, at your option)! Extended life as coils are rigid and will not fatigue or collapse under temperature cycles!



KNAPP PROCESS

Homogeneous Lead Covered copper tubing is fabricated on homogeneous lead-covered steel legs. Such legs eliminate unsatisfactory lead spacer blocks. They provide rigid construction and permit the tubing to expand and contract freely.

Operating Data

Coils may be operated at steam pressures up to 150 psi and the homogeneous bond between copper and lead will withstand up to 500 F. The strength of the coil in respect to internal pressure and rigidity relies solely on the copper tubing, thus the homogeneous lead covering may be kept at a minimum.

Tubing available in lengths or coils for your own fabrication



SEND FOR
a sample of homogeneous Pb covered copper as produced by the Knapp Process. No obligation.

KNAPP MILLS, INC.

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PLANTS AT: Wakefield, Mass. - Long Island City, N. Y.
Harrisburg, Pa. - Wilmington, Del. - Baltimore, Md.

NAMES IN THE NEWS, cont.

sented at a dinner meeting in Dayton on May 14.

Ben S. Wright has been appointed vice president of Owens-Corning Fiberglas Corp. and general sales manager. His headquarters are at the firm's general offices in Toledo.

R. M. Burns, chemical director of the Bell Telephone Laboratories, has been elected chairman of the New York section of the American Chemical Society. Dr. Burns takes office on July 1, succeeding Clifford F. Rasweiler, vice president for research and development of the Johns-Manville Corp.

R. E. Rayford of the University of Wisconsin has been awarded one of the Pure Oil fellowships for graduate study and research at Northwestern University.

Robert M. Crawford has resigned as an officer and employee of Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. He plans to engage in the business of consulting engineer to the chemical and allied industries.

L. C. Cartwright has been elected secretary, Albert F. Guiteras, treasurer, and Louis J. Bowlby, Jr., assistant treasurer, of Foster D. Snell, Inc., New York.

Arne Olson has been appointed chief process engineer and R. H. Hazlett is manager of the oil and gas department of the chemical plants division of Blaw-Knox Co., Pittsburgh.

Kenneth Tator, corrosion specialist and chemical engineer, has organized Kenneth Tator Associates, to provide surveys, analyses, recommendations and supervision of corrosion control methods and materials.

Franklin D. Jones has been appointed to the consulting staff of Mancey Chemical Co., Philadelphia.

Raymond L. Geiler has been elected president of A. R. Maas Chemical Co., South Gate, Calif. He succeeds Holger Stongard who died in March. Thomas F. Edson has been elected executive vice president and Fred C. Bowman was made vice president.

J. V. Powell is now general manager, development department, of Oro-
(Continued)

WE'LL STICK TO

Basic Ideas

In Design,
Construction
and Materials



It is a fine thing to propose wonderful theoretical ideas about well water systems and vertical turbine pumps, but Layne never ventures away from everyday basic ideas. That fact may account for the world-wide use and popularity of Layne Well Water producing equipment. It certainly accounts for such things as high efficiency, rugged construction and reliability of operation. So until the impossible happens, you can be sure that Layne engineers and designers are sticking to basic ideas that always pay off in satisfaction to the user.

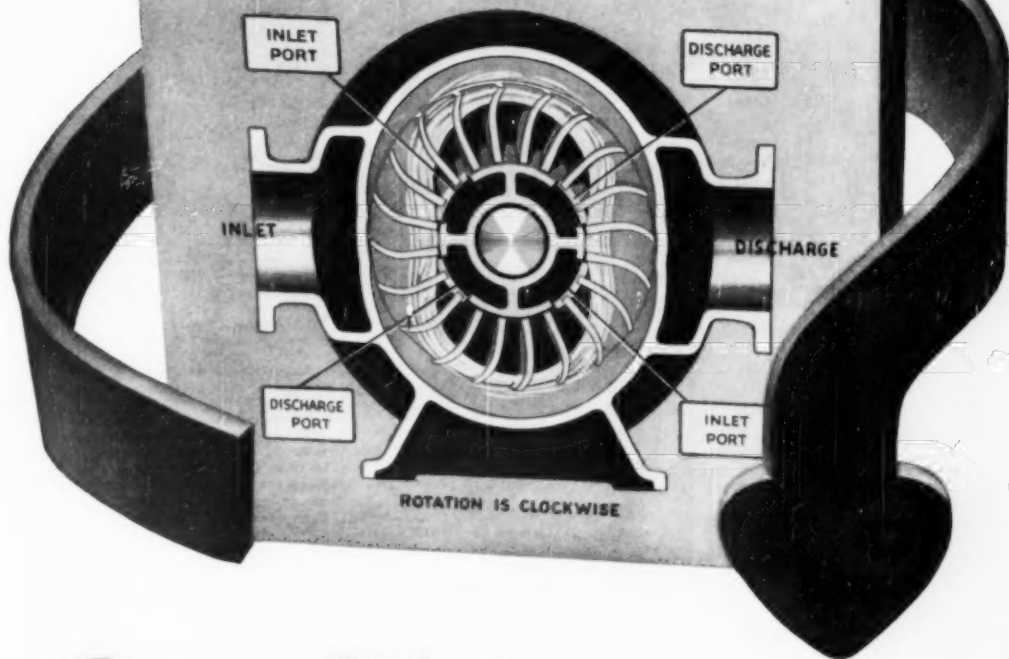
Of course Layne Well Water Systems are as modern as tomorrow, in that they are properly designed and constructed of the finest tested and proved materials. Furthermore they are as accurate in precision building as modern tooling and experienced workmanship can make them.

In buying a well water system, you naturally want a full dollar's worth of value. You want a maximum amount of water at a minimum of daily operation cost—plus freedom from breakdown and repair expense. Those requirements just about sum up exactly what you get when you choose a Layne Well Water System. For further information, catalogs, bulletins, etc., address Layne & Bowler, Inc., Memphis 8, Tenn.

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AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. • Layne-Atlantic Co., Norfolk, Va. • Layne-Central Co., Memphis, Tenn. • Layne-Northern Co., Milwaukee, Ind. • Layne-Louisiana Co., Lake Charles, La. • Louisiana Well Co., Monroe, La. • Layne-New York Co., New York City • Layne-Northeast Co., Milwaukee, Wis. • Layne-Ohio Co., Columbus, Ohio • Layne-Pacific, Inc., Seattle, Wash. • Layne-Texas Co., Houston, Texas • Layne-Western Co., Kansas City, Mo. • Layne-Minnesota Co., Minneapolis, Minn. • International Water Corporation, Pittsburgh, Pa. • International Water Supply, Ltd., London, Eng. • Layne-Huachuco Americana, S. A., Mexico, D. F.

**Nash Instrument Air Compressors
deliver only clean air, free from
oil or dust, and without filters**



Here is Why!

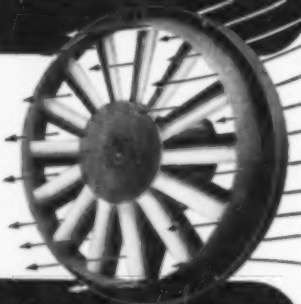
You can dispense with oil filters and dust filters when you install ©Nash® Clean Air Compressors. You can save the cost of maintaining these devices. You can greatly reduce instrument maintenance costs. For the Nash employs no internal lubrication, therefore no troublesome oil is in the delivered air. Moreover, air from a Nash is thoroughly washed and cooled as it passes thru the pump. Dust in the plant atmosphere, even fly ash, is immediately removed.

©Nash® Clean Air Compressors are simple, with only one moving element. No valves, gears, pistons, sliding vanes, or other enemies of long life and constant performance complicate a Nash. No aftercoolers are needed. You will find it profitable to investigate these pumps, now.

No oil filters.
No dust filters.
No internal lubrication to contaminate air handled.
No internal wearing parts.
No valves, pistons, or vanes.
Non-pulsating pressure.
Original performance constant over a long pump life.
Low maintenance cost.

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efficiency plus



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AXIAL-FLOW
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have all 3**

1 HELICOPTER-TYPE FAN BLADES

Greater Efficiency! Provides quiet, uniform air velocity from hub to blade tip. Non-overload power characteristic prevents motor burn-out.

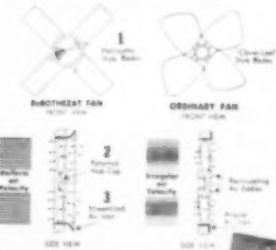
2 PATENTED HUB CAP--

Prevents Recirculation at Fan Hub! Eliminates re-entry of exhausted air at hub, making it unnecessary to re-discharge air once moved.

3 STREAMLINED AIR INLET --

Up to 16% More Efficient Than Ordinary Inlets! Logarithmic entrance ring eliminates sharp bends in the air stream. Full use of fan blade tip velocity is achieved.

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ACTUAL WIND TUNNEL TESTS!**



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NAMES IN THE NEWS, CONT.

nite Chemical Co., San Francisco. Powell will now head up product development, technical service, market research and engineering.

George O. G. Löf has joined the staff of the University of Denver as professor and chairman of the department of chemical engineering. He has also been appointed acting director of the Industrial Research Institute at the University of Denver. Löf was formerly with the University of Colorado and more recently technical director of the Denver operations of Colorado Fuel & Iron Corp.

George G. Cocks has joined the research staff of Batelle Institute, Columbus.

Morton D. Shavit, recent graduate from New York University, has joined the Air Force Munitions Branch, Munitions Division, Technical Command, Army Chemical Center, Md., as a chemical ordnance engineer.

W. H. Zugschwerdt has been named plant manager for the Holston Defense Corp., subsidiary of Eastman Kodak Co., at the Holston Ordnance Works.

Charles H. Prien has joined the University of Denver as assistant professor of chemical engineering and research associate in the Industrial Research Institute at the University. Dr. Prien had formerly been assistant professor of chemical engineering at the University of Colorado, Boulder.

Frank B. Hodgdon has accepted an appointment in the research department of the American Lava Corp., manufacturers of technical ceramics, at Chattanooga, Tenn.

Donald D. Kingery has been named assistant plant superintendent at the Hercules Powder Co. plant in Brunswick, Ga. He will be in charge of liquid products.

Richard E. Shope has resigned from the Rockefeller Institute for Medical Research, Princeton, N. J., to join the Merck Institute for Therapeutic Research as associate director.

D. P. Morgan has been named vice president and treasurer of Mathieson Chemical Corp. succeeding Howard Berry who has resigned preparatory to retirement. Dr. Mor-

The New
XACTLINE

**STRAIGHT LINE
TEMPERATURE CONTROL**

**For Use With
Pyrometer Controllers**



Anticipates
Temperature Change
Eliminates Overshoot
and Undershoot

Now with XACT-
LINE Straight Line
Temperature Control
you can in-
crease the effi-
ciency of your Pyrometer

Control Instruments (either
Millivoltmeter or Potentiometer Type) to an

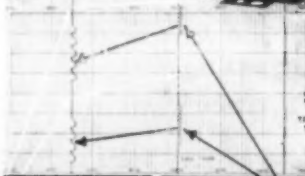
amazing degree. Now you can hold tolerances as close as 1/5°F. plus or minus and power "on-off" cycles as low as 3 seconds.

For XACTLINE, operating in the thermocouple circuit, ANTICIPATES the most minute heat variations on both heating and cooling cycles, thereby enabling your pyrometer controller to control far more closely than otherwise possible.

This Anticipation Factor means that XACTLINE causes the conventional pyrometer controller to respond to a millivoltage impulse up to 90% less than that normally required, (the controlling pyrometer functions only when the desired temperature range has already been exceeded).

XACTLINE is laboratory tested and adjusted . . . does not require readjustment or coordination with other controllers.

NO gears, cams, shafts,
bearings or other rotating or
sliding parts. Simple design
eliminates usual maintenance
and repair.



Xactline in Circuit Pyrometer Only

PRECISE CONTROL FOR . . . Tempering-Drawing . . . Iso-Thermal Quenching . . . Al and Mg Treatment . . . Accurate Heat Treating . . . Sintering . . . Metallic Baths . . . Plastic Molding . . . and other operations . . . Price complete P. O. B. Factory . . .

\$79.50


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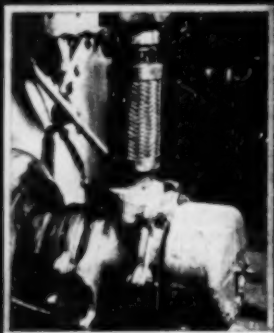
if it MOVES...and it's STEAM

AT A LARGE RUBBER COMPANY PLANT, American $\frac{1}{2}$ " and $\frac{3}{4}$ " I.D. S-1 Bronze Seamless Flexible Metal Hose is used for conveying steam to automobile tire tube presses. At the time the photographs were taken, these flexible assemblies had been in continuous operation for 1½ years without a leak—and, of course, are good for much more steam-tight service.

American Flexible Metal Tubing for Heavy Duty Steam Lines

WHERE THERE ARE MOVING PARTS...or vibration...in connection with steam lines, American Seamless Flexible Metal Connectors are in order. Seamless has the flexibility of rope...provides safety insurance against leaking live steam, slippery floors...prevents transmission of vibration from pumps and compressors. Made of bronze, with protective bronze wire braid, this tubing is exceptionally resistant to corrosion—is rugged and long-lasting.

For flexible service in a multitude of applications—conveying semi-solids, liquids, gases, etc.—there are two basic types of American Metal Hose products: *Seamless Tubing*, corrugated for maximum flexibility and *Flexible Metal Hose*, made from spirally wound strip with joints packed or unpacked. These two types are available in a wide choice of metals and sizes—with numerous variations in construction, braids and protective cas-



SHORT SECTIONS of 2" I.D. American Seamless Bronze Tubing, wire-braid covered for extra strength, are installed in the steam headers of a paper making machine to compensate for movement. Scene is at the Beloit Iron Works, Beloit, Wisconsin.

ings—and supplied complete, if you wish, with standard or special end fittings attached.

In improving the operation of old equipment, or in designing new, be safe with American Flexible Metal Hose and Tubing. Our Technical Department will help you to find the connector which best suits your needs.

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Mike

and the
MANUAL MILL



O! Mike's a brawny Irishman
From Ireland's emerald greens.
He landed with us years ago
When only in his teens.

We showed him how to operate
Our pulverizing plant.
"An' thin me troubles just began,"
(He used to rave and rant.)

"I'd pull me gates wot shot the
feed
To grind, or dry, or mix
An' alweez git too much or not
Enough—an orful fix!

"The mill'd belch an off-tune note,
The dryer'd sizzle hot,
An' me, I'd try to find the gate
To git us off the spot!"

But years have come and years
have gone
And times have changed a bit,
A more abundant life has Mike
With much more time to sit.

A single gadget does the job
That gave him all the grief.
No tending gates, no juggling
feed,

No watching mills—in brief,
Production's up, our costs are
down,
Our products fine because
"ELECTRIC EAR"® is standing
guard . . .
And Mike is now "the boss"!

* Write for *Hardinge Bulletin*
42-11 describing the "Electric
Ear" (reg. U. S. Pat. Off.)—
the only device of its kind that
controls feed rate in grinding
mills by "listening" to the
sound of the rotating load.

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NAMES IN THE NEWS, cont. . .

gan joined Mathieson in 1948 and
has been vice president in charge
of the development department.

Charles L. Shrewsbury, has joined the
staff of Southwest Research Insti-
tute, San Antonio, as chairman of
agricultural chemistry for the in-
stitute and associate director of the
Foundation of Applied Research.

Chandler Jordan, municipal director of
public works for the City of Nat-
chez, Miss., has resigned to accept
a position with the International
Paper Co. at Natchez.

S. D. Cornell has been appointed di-
rector of the planning division of
the Research and Development
Board.

Donald N. McCord has joined the
Glenn H. McCarthy organization,
Houston, owner of the new Mc-
Carthy Chemical Co. plant at Win-
nie, Tex. McCord's duties will
cover the supervision of plant and
construction projects for McCarthy.

John L. Gillis has been named acting
general manager of Monsanto
Chemical Co.'s Merrimac division.
Mr. Gillis will direct the activities
of the Merrimac plants in Everett,
Mass., and Camden, N. J., in the
absence of J. B. Rutter, Merrimac
general manager, who is on a leave
of absence.

J. M. Newton, research supervisor for
Clinton Industries, Clinton, Iowa,
has been appointed director of the
company's technical sales service
department.

Carl W. Schwenzfeier, Jr., has been
named technical manager of the
Luckey, Ohio, magnesium plant at
which the Brush Beryllium Co. will
manufacture beryllium for the
Atomic Energy Commission.

Benjamin J. May, general manager of
the Du Pont rayon department, and
Arnold E. Pitcher, general manager
of the plastics department, will both
retire at the end of this month.

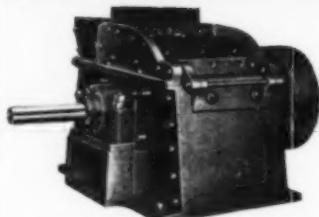
William C. Waggener and Robert W.
Atteberry have joined the Oak
Ridge National Laboratory Chemis-
try Division as research chemists.

Robert L. Baldwin has been appointed
assistant to G. A. Wallerstedt, west-
ern district manager for Hardinge
Co. Baldwin will assist in sales de-
velopment, using the Hardinge

(Continued)

DIXIE HAMMERMILLS

for
grinding • pulverizing
crushing • shredding
(stationary breaker plate type)



2018 Dixie Premier Jr. Sectional
construction makes all parts easily
accessible and the size of the
finished product may be changed
within a few minutes by simply
adjusting breaker plate.

Widely chosen by engi-
neers in the Chemical
Processing industries,
Dixie Swing Hammer
Crushers are sturdily con-
structed and incorporate
distinct time, labor and
money-saving principles
. . . the result of design
innovations spearheaded
by years of painstaking re-
search and engineering
"know-how".

Made in type and sizes which will
reduce from 1 up to 500 tons per
hour, Dixie Hammermills have the
capacity and ability to reduce in
one operation, saving their cost
many times over through their
greater ratio of reduction and by
delivering more tonnage per horse-
power in actual year-in and year-
out tests.

Assistance in the solution of your
reduction problems is an estab-
lished Dixie service that incurs no
obligation.

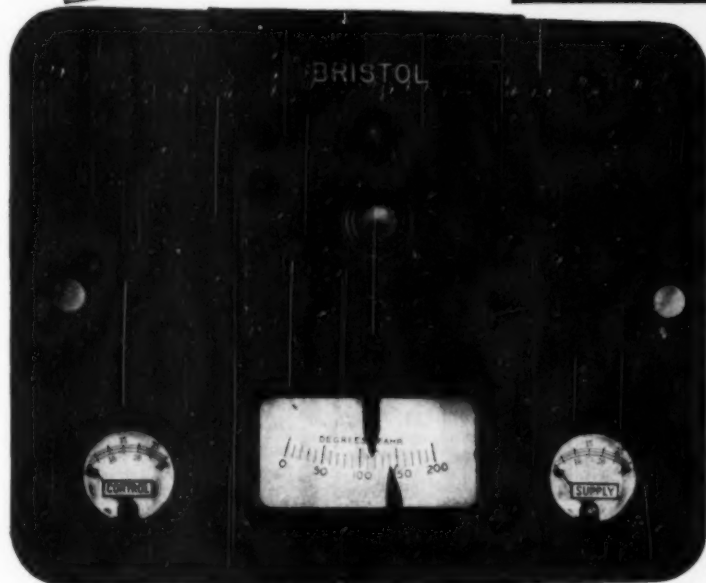
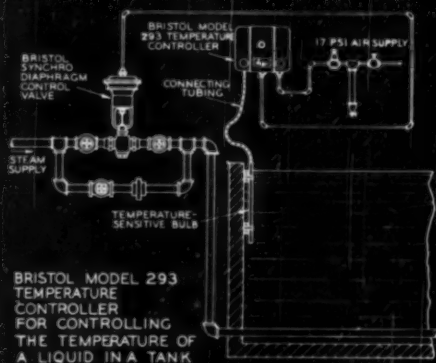
WRITE TODAY FOR HELPFUL
INFORMATION, SPECIFICATIONS
AND DESCRIPTIVE LITERATURE.

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MACHINERY MFG. CO.

Main office and plant
4172 Goodfellow Ave.
St. Louis 20, Mo.

WHERE VARIABLES
must be controlled
BUT NOT NECESSARILY
recorded



Here
**ARE THE VARIABLES
 THE MODEL 93
 CAN CONTROL**

Temperatures
 from -125° to 1000° F.

Pressures
 from full vacuum to 4000 psi.

Liquid Level
 in open or closed vessels.

Humidity
 from 0 to 100% R. H.

Flow
 of steam, gas, air and liquids
 through pipes.

Bristol's new Model 93 Air-operated Controllers are designed for those cases where you want variables put under accurate control, but where chart records are either not required or are otherwise provided for.

Model 93 is a small, compact, simple instrument having a precision measuring element and Bristol's Free-Vane Control—the frictionless system which is the most accurate of all air-operated designs. You get an absolutely true visual indication of results.

A new bulletin, No. A115, gives complete details. Write for a free copy to 109 Bristol Road, Waterbury 91, Conn.

THE BRISTOL COMPANY, WATERBURY 91, CONNECTICUT

60 YEARS...1889-1949

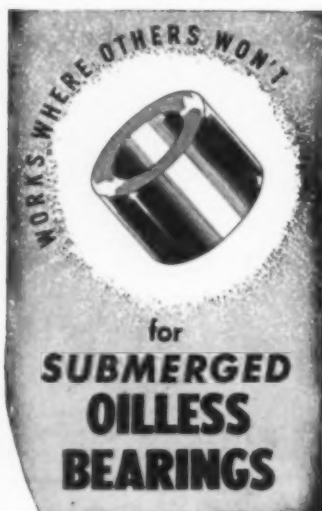
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Engineers Process Control
 for Better Products and Profits



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**AUTOMATIC CONTROLLING, RECORDING AND
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- OPERATE DRY or SUBMERGED IN DYES, PLATING, CLEANING & CHEMICAL SOLUTIONS, GASOLINE, FOODSTUFFS
- TRULY OILLESS AND SELF-LUBRICATING
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- APPLICABLE OVER A WIDE TEMPERATURE RANGE—even where oil solidifies or carbonizes
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- ROTATING SEALS OF GRAPHALLOY ARE UNEXCELLED

GRAPHITE METALLIZING CORPORATION

1024 NEPPERHAN AVENUE, TONKERS 3, NEW YORK

NAMES IN THE NEWS, cont. . .

office at San Francisco as headquarters.

Warren K. Lewis of the Massachusetts Institute of Technology was the recipient of the Gold Medal Award of the American Institute of Chemists. Presentation took place at the Chicago meeting May 7.

Hal G. Johnson has been appointed to the position of assistant director of the development department of Monsanto Chemical Co. Dr. Johnson, who has been a coordinator in the development department of the organic chemicals division, succeeds **W. Kenneth Menke** who has been appointed assistant general manager of sales for the company's Merrimac division at Everett, Mass.

Maurice Kramer, who joined Wyandotte Chemicals in 1946, was recently appointed supervisor of the laundry and textile laboratories of their research department.

A. H. McKee has joined the technical staff of Sapolin Paints Inc., New York.

J. T. Deane, vice president of Oronite Chemical Co., will move to San Francisco from New Orleans to take charge of all Oronite manufacturing operations. **T. I. Clausen**, who has been acting assistant to the manager, chemicals division, at California Research Corp., another Standard of California subsidiary, is transferring to Oronite in New Orleans to be in charge of manufacturing operations at the Oak Point plant.

R. D. Sprenger of the College of Puget Sound, Tacoma, Wash., has been elected chairman of the Puget Sound section of the American Chemical Society. He succeeds **Joseph L. McCarthy** of the University of Washington.

Walter M. Urbain, head of the division of physics and physical chemistry at the Swift & Co. research laboratories, has been elected chairman of the Chicago section of the American Chemical Society for 1949-50. Dr. Urbain will take office on July 1, succeeding **Charles L. Thomas**, director of research of the Great Lakes Carbon Corp.

Otto Kay, senior chemist in research and development for the Solvey Process division of the Allied Chemical and Dye Corp., Syracuse, N. Y., has joined the staff of Armour Re-

(Continued)

WANTED: YOUR SPRAY PROBLEMS!



Fig. 631

Are all of your processes using Spray Nozzles as efficient as you think they could be? Do the Sprays distribute the liquid evenly? Break it up into as fine particles as you would like? Resist the corrosion or wear conditions satisfactorily?

Send Monarch an outline of any spray problem—if your liquid can be sprayed with direct pressure at all—Monarch can furnish the nozzles.

NOZZLES FOR:

- ACID CHAMBERS
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- GAS SCRUBBING
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- OIL BURNERS
- SPRAY DRYING

Do you have our Catalogs
6A and 6C?

MONARCH MFG. WORKS, INC.
2513 E. ONTARIO ST.
PHILADELPHIA 34, PA.

FOR LEAKPROOF, TROUBLE-FREE PIPE RUNS

Cut-away view of a Walseal Tee showing ring of silver brazed alloy, and completed Silbraz joint.



**Specify
Walseal*
Products**

On all types of piping jobs where Type "B" copper or red brass pipe is used, trouble can be avoided by installing Silbraz* joints — made with Walseal valves, fittings and flanges.

Threadless, patented Silbraz joints are silver brazed (not soft soldered) pipe joints that are leakproof, trouble-free — permanent ... connections that will not creep or pull apart; that literally join with the piping system to form a "one-piece pipe line". Thus, these modern joints eliminate the need for maintenance and costly repairs — especially important where lowered operating costs are imperative.

For complete details on the modern Silbraz joint, made with Walseal products, write for a copy of Walworth Circular 84.

*Patented — Reg. U. S. Patent Office.

Make it a "one-piece pipe line" with WALSEAL

WALWORTH
valves and fittings

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Recommended for

Hot and Cold Water
Circulating Systems

Boiler Feed Lines

Steam Return Lines

Condensate Lines

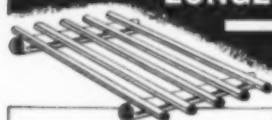
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ing Systems

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Piping Systems

NEW ROUND-ROD SCREEN ... Stays Cleaner ... LASTS LONGER!



Precision-Welded Stainless Steel

* SAVE with exclusive B-Z Round Rod Design

Round-Rod design plus stainless steel, all-welded construction means a clean, long-lasting processing screen. Comparisons show that B-Z Round-Rod Screens give greater value than any other type.

Even with 50% wear,

B-Z Screen openings remain constant! Wear at top does not affect horizontal diameters — one of the big features of B-Z Round-Rod Screens.



Fine point of contact

between stainless steel Round-Rod and tie-rod is electric welded. Clagging or blinding is eliminated, assuring clean, accurate screening.



CUSTOM - ENGINEERED TO YOUR SPECIFICATIONS

—to fit your vibrators, shakers, sizers and other screening machines. Size, type, dimension, shape and mounting is "custom engineered" to meet your specifications . . . to give the greatest possible screening efficiency for the longest period of time.

SEND for New Catalog

Write for the free catalog with complete facts on B-Z Round-Rod Screens and how they may be custom-engineered to fit your plant machinery.



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ZIMMER**
ENGINEERING CO.

Dept. 46 ; 961 Abingdon St., Galesburg, Ill.

NAMES IN THE NEWS, cont.

search Foundation of Illinois Institute of Technology.

F. E. Lacey, who has been head of the industrial oil department of Swift & Co. since 1944, has been appointed manager of the Swift technical products plant located at Hammond, Ind.

G. H. McIntyre, vice president and director of research for Ferro Enamel Corp., has been named head of a newly formed control research division.

Russell D. Hanna has been transferred to Hercules Powder Co.'s Chicago branch sales office, where he is a member of the company's cellulose products plastics promotion group.

Elmer H. Leslie, chemist, has joined the research staff of Battelle Institute, Columbus.

OBITUARIES

Angus Beresford Kennedy, 63, consulting engineer with the Vulcan Copper & Supply Co., died March 18.

Archibald McIntyre Maxwell, 53, director and vice president in charge of refinery sales of the Standard Oil Co. (Ohio) died in Cleveland, April 18.

Samuel K. Varnes, for many years chief engineer of Du Pont's ammonia department, died April 18.

C. Neal Barney, 73, vice president, secretary and general counsel of Worthington Pump and Machinery Corp. died at his home in Scarsdale, N. Y., April 24.

Samuel Warren Mays, 65, retired executive of the American Cyanamid Co., died at his home in Bronxville, N. Y., May 8.

Calvin James Dean, 50, a senior petroleum engineer for the General Petroleum Corp., died at his home in South Pasadena, May 9.

Floyd F. Oplinger, manager of electroplating service and development in Du Pont's electrochemicals department and nationally known in the electroplating field, died in West Chester, Pa., May 9.

Arthur C. Boylston, 67, president of the Mallinckrodt Chemical Works of St. Louis, died at his home in Carsonville, Mo., May 10.

ROTH STAINLESS PUMPS

Capacity 2 to 180 GPM
Head 0 to 400 Feet



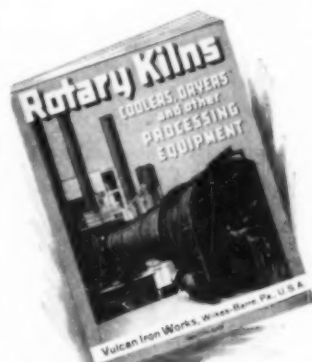
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ROY E. ROTH COMPANY

2480

4th Ave.

Rock Island, Illinois



GET THE FACTS

regarding VULCAN Custom-Built Equipment for Process Industries.

For a quick picture see our 12-page illustrated insert in the Chemical Engineering Catalog.

For the complete story ask us to send you Bulletin 442-C. Its 28 large pages are fully illustrated and packed with information.

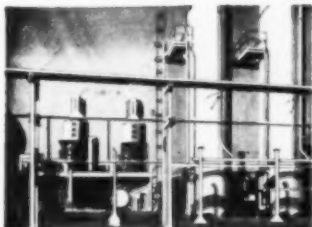
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Vulcan Iron Works
WILKES-BARRE, PA., U. S. A.

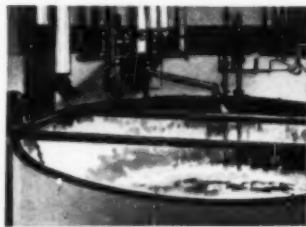
Are Your Corrosion Problems As Severe As These?



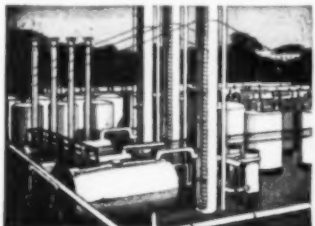
You won't be discouraged by any corrosion problem, when you read how these four companies have finally controlled extremely severe corrosion in their plants with a system of UCILON Protective Coatings!



1. A WELL KNOWN REFINERY had Ucilon coatings applied to ducts exhausting oil and gasoline fumes at the cracking tower. One year after application, there was still not a sign of failure, despite the severity of the service.



2. A SOAP PLANT had a tough ceiling maintenance problem—some ordinary paints being destroyed by fatty acid vapors in as little as 2 weeks. Yet after 6 months of exposure, Ucilon coatings were still totally unaffected!



3. A CHEMICAL PROCESSOR coated a steel storage tank with a Ucilon coating system. Especially hard on protective coatings, the tank's contents broke down two other coatings tried—one in 6 weeks. Yet Ucilon is still in good condition after 14 months!



4. IN THE BOTTLING ROOM of one company, painting of machines was considered to be almost useless—until they discovered Ucilon. Nothing ever tried even approaches the effectiveness of Ucilon, which for 2 years has been withstanding the humidity and spillage!

Similar reports continue to arrive from plants of every nature. Maintenance men are discovering a degree of corrosion protection and service life they never achieved with any coating tried before. If you have an exceptionally tough coating problem, we're confident that there's a Ucilon coating system to help you stop corrosion damage and vastly lengthen the period between your paint jobs. Let us send you our specific recommendations without obligation. Write today, outlining the details of your application.



UCILON* 400

Ucilon 400 is a flexible, glossy, air-drying coating for metal, concrete and wood. It is applied by brushing or spraying. When solvents evaporate, a tough "plastic" film is formed. Ucilon 400 provides exceptional resistance to acids, alkalis, alcohols, oils and greases, salts, water, cleaning compounds, oxidizing agents.

OTHER UCILON COATINGS

Ucilon 1601—a ready-mixed, extra-bright aluminum paint with exceptional outdoor resistance. It stays bright under prolonged exposure, withstands elevated temperatures.

Ucilon 1501—a very hard, chip-resistant baking coating which resists chemical attack at temperatures higher than recommended for Ucilon 400.



SEND FOR THIS BULLETIN which gives more details on various Ucilon coatings and their properties.

*Trade Mark Reg. U. S. Pat. Off.

UCILON Protective Coatings



products of UNITED CHROMIUM, INCORPORATED

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CHEMICAL ENGINEERING—June 1949

it's in the AIR

There's plenty of Oxygen in the air and you can extract what you need, as you need it, by leasing Air Products generators and making your own.

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OXYGEN

BY THE TON

With Air Products generators, your OXYGEN flows from the generator, through your pipe line, to the points of use, without handling.

You control your own supply and remove the risk of costly shut-downs which often result from delivery failure.

You eliminate the cost of handling, delivery, evaporation loss and selling cost, which is a large percentage of the total cost.

If you use over 200,000 cubic feet per month, you can assure your supply at low cost, without capital investment for equipment, by leasing Air Products generators and making your own oxygen from air. These same generators also produce high-quality nitrogen gas.



How to Cash-In on this Proven Method

Let us know how much OXYGEN you use per month, minimum and peak demands, whether you own a pipe line and storage tank, and any other pertinent information. We will show you how to make very substantial savings, as many other firms have done. Names on request.

AIR PRODUCTS, INC.
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Allentown, Pa.

Assure Your Supply at low cost with

Air Products
OXYGEN GENERATORS

INDUSTRIAL NOTES

Koppers Co., Pittsburgh, has named J. C. Macon, Jr., sales manager of the tar products division. He succeeds R. R. Holmes, who recently was named as assistant general manager of the division. John N. Fencil has been appointed eastern district sales manager of the division.

Chain Belt Co., Milwaukee, has moved its Los Angeles district office and warehouse to new and larger quarters at 3838 Santa Fe Ave., Los Angeles 11, Calif.

American Flange & Mfg. Co., Inc., New York, has opened a new plant in Linden, N. J., to manufacture closures.

Binney & Smith Co., New York, has announced the formation of Binney & Smith Co. International, a wholly owned subsidiary, to handle its rapidly expanding worldwide operations.

Shell Chemical Corp., New York, has formed a new department to consolidate the marketing of all Shell

Oil and Shell Chemical agricultural products.

Republic Flow Meters Co., Chicago, has appointed Kenneth K. Kenzel manager of its Cincinnati district office.

Glidden Co., Cleveland, Ohio, has named Henry D. Coulton sales manager of its eastern direct sales division in Reading, Pa.

Esso Standard Oil Co., New York, has established a new sales group within its marketing department for the sale of products formerly handled by Stanco Inc., an affiliate recently merged with Esso.

American Mineral Spirits Co., Chicago, has appointed G. J. Zahring, Jr., to its Chicago sales staff.

Union Bag & Paper Corp., New York, has made S. K. Bradley eastern district manager of multiwall sales. E. M. Rickel has been made director of chain store sales. R. B. (Continued)

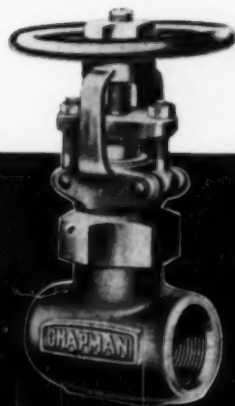
CATAWISSA
BALL-TO-ANGLE SEAT
gives you a
PERFECT SEAL...

**...even when
the pipe is not
perfectly aligned!**

**HOT FORGED STEEL
STAINLESS STEEL**
Full ACME Threads or
U. S. V-Threads in
Union nuts and on female
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STANDARD AND
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HEAVY

WRITE FOR COMPLETE ENGINEERING DATA
AND YOUR COPY OF BULLETIN 10 A.

CATAWISSA VALVE & FITTINGS CO.
100 Mill St. • CATAWISSA, PENNSYLVANIA



New Design Feature CHAPMAN VALVE List 960

Gives more than 50% increase in strength of stem and wedge gate connection...meets the most extreme operating conditions.

Valve stems and gates with the new scientifically designed connection are interchangeable with all List 960 Valves now in service

Here's one more result of the year after year program of research which Chapman carries on to make the List 960 *tops for toughness*. Reason why this small gate valve can lower your maintenance cost — give you more years of useful valve life.

Consistently you will find the Chapman List 960 is *your best valve buy*. It is available in sizes $\frac{1}{4}$ " to 2" . . . rising stem with yoke (as illustrated). Also available rising stem inside screw type. For pressure range 2000 lb. at 100 deg. F., 380 lb. at 1000 deg. F.

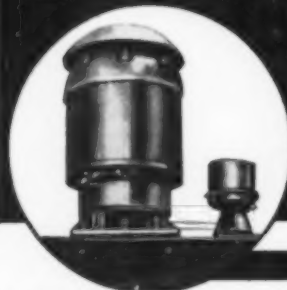
For higher pressures specify List 990.

Secret of this 50% increase in strength of the stem and wedge gate connection lies in its new design which compensates at points where excessive stresses can develop.

And don't forget the wear resisting and non-galling properties of the hard heat treated seat rings and the 800 Brinell hardening of the wedge faces by the exclusive Malcomizing Process.

The Chapman Valve Mfg. Co., Indian Orchard, Massachusetts

"CENTROID" SPEED CONTROL AN EXCLUSIVE WITH



Fletcher

CENTRIFUGALS

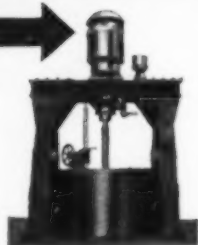
"CENTROID" provides for automatically regulated unloading speed of only 50 RPM. This means safe, efficient discharging of centrifugal baskets.

"CENTROID" enables operator to give all his attention to handling the unloader.

"CENTROID" gives Fletcher Centrifugals 3 speeds: one for loading, one for spinning, and one for unloading. Fletcher Centrifugals increase your production . . . require less attention.

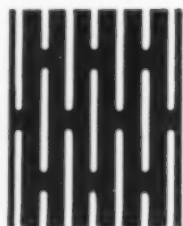
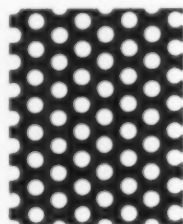
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When Corrosion is a screening problem

For processes where it is important that equipment be corrosion-resistant, Hendrick furnishes perforated metal screens of stainless steel, Monel, Everdur, bronze copper or aluminum.

Such screens can be supplied with any of the hundreds of standard shapes and sizes of perforations in the regular Hendrick line, or they will be made to specifications to meet unusual requirements. Write for full information.



Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Trends and
Armorgrids

HENDRICK

Manufacturing Company

51 DUNDAFF STREET, CARBONDALE, PENNA.

Sales Offices In Principal Cities

INDUSTRIAL NOTES, CONT.

Bennett has been made district manager of flexible packaging sales.

General Electric, Pittsfield, Mass., has made Robert G. Baumann assistant sales manager of silicone products in its chemical department.

Gas Machinery Co., Cleveland, has appointed David S. Reynolds its New England representative.

Snyder Tool & Engineering Co., Detroit, has purchased Arthur Colton Co.

Innis, Spiden & Co., New York, has appointed E. T. Ladd vice president in charge of its Isco chemical division at Niagara Falls. C. H. Berle has been made works manager of Isco.

Quaker Rubber Corp., Philadelphia, has appointed John R. Lewis district manager of the greater part of the eastern states.

Goodyear Tire & Rubber Co., Akron, Ohio, has named J. A. Weatherford special sales representative of the chemicals division with headquarters at Chicago.

American Cyanamid Co., New York, has appointed C. F. Bonnet as production manager of its industrial chemical division. G. W. Russell has been made assistant sales manager.

General Aniline & Film Corp., has appointed William H. Healey supervisor of market research for its Antara Products division.

Koppers Co., Inc., Pittsburgh, Pa., has opened a New England district sales office at 250 Stuart St., Boston, Mass. J. W. LaBelle has been named manager of the office.

General Petroleum Corp., Los Angeles, has named Charles H. Wartman manager of its marketing department. He succeeds Vernon A. Bellman who has been made vice president and director of marketing. Baxter F. Ball has been named to take over Mr. Wartman's former position, assistant to the vice president in charge of marketing.

United States Rubber Co., New York, has appointed James E. Power manager of national accounts sales for its mechanical goods division. W. A. Tipton has been made manager of branch sales for the mechanical

(Continued)

"Why You Should Specify SOLVAY"

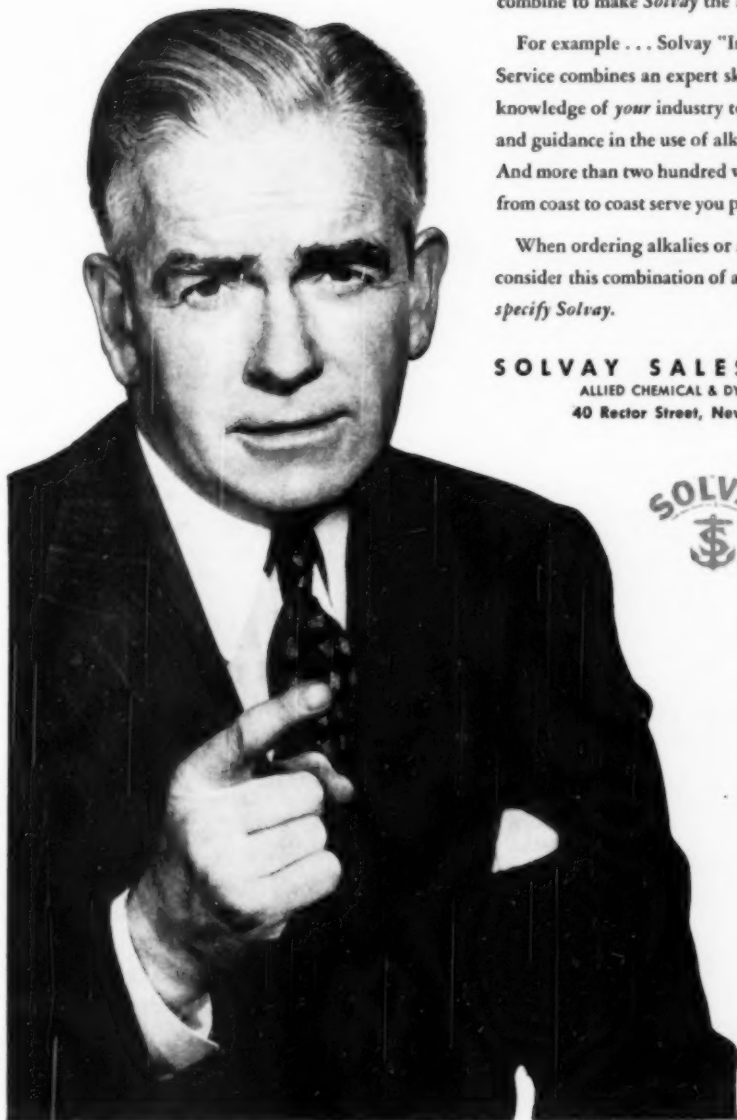
Chemicals are not bought on the basis of price and specifications alone. Other factors must be considered . . . plant facilities, plant locations, length of experience. Technical Service, convenience of warehouse locations for prompt and economical delivery. All these combine to make *Solvay* the logical choice for alkalis.

For example . . . Solvay "Industry-Wise" Technical Service combines an expert skill in alkalis with an intimate knowledge of *your* industry to offer invaluable counsel and guidance in the use of alkalis and associated chemicals. And more than two hundred warehouses and stock points from coast to coast serve you promptly and economically.

When ordering alkalis or associated chemicals, consider this combination of advantages and you, too, will *specify Solvay*.

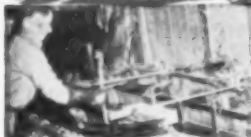
SOLVAY SALES DIVISION

ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.



Soda Ash
Caustic Soda
Caustic Potash
Chlorine
Potassium Carbonate
Calcium Chloride
Nytrol
Sodium Bicarbonate
Specialty Cleansers
Ammonium Bicarbonate
Sodium Nitrite
Para-dichlorobenzene
Ortho-dichlorobenzene
Monochlorobenzene
Methanol
Ammonium Chloride
Formaldehyde

IN Chemical Process Equipment



High temperature chrome plating in Atlas tank.



This dye plant Atlas floor is proof against strong acids, alkalis and organic solvents.



Among the acid wastes conveyed by this 1200' Atlas trench are sulphuric and hydrochloric acids, chlorinated organic solvents, alkalis, etc.



This Atlas-designed ammonia saturator deals with solvents and acids at high temperatures.

this type of acid-proof construction brings Continuing Economies

These economies include freedom from corrosion troubles — production uninterrupted by corrosion damage — units that keep on serving year in, year out, without time off for repair and maintenance.

Atlas corrosion-proof construction means proven design — and materials proof against, not merely "resistant to" acids, alkalis, solvents, oils, greases, water, steam and high temperatures.

It means acid-handling units custom-planned to solve your individual problems, no matter what corrosives they may involve.

Atlas construction serves in the world's leading chemical and steel producing plants — in tanks, floors, towers, stacks, saturators, sewers, neutralizing and disposal pits.

Atlas engineers will gladly collaborate with your engineers — or will take over the entire acid-proofing problem and solve it satisfactorily — and permanently. Recommendations, plans and estimates will be furnished without obligation. You can reach a technically qualified Atlas representative at our nearest branch. Write our Mertztown Office for Technical Bulletin

THE Atlas Mineral

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*Stock carried at these points

IN CANADA: H. L. BLACHFORD, Limited, MONTREAL AND TORONTO

INDUSTRIAL NOTES, CONT.

goods division and O. S. True district sales manager for the division's New York branch. Edward L. Lockman has been named manager of tank lining and roll covering sales.

Metalsalts Corp. has been granted exclusive sales rights on the products of Darsyn Laboratories, Hawthorne, N. J., a subsidiary corporation which formerly handled its own distribution.

Ferro Enamel Corp., Cleveland, Ohio, has formed a central research division to coordinate all corporate research activities. The new division will be headed by Dr. G. H. McIntyre, vice president and director of research.

Dow Chemical Co., Midland, Mich., has promoted Donald Williams from general sales manager to director of sales. Donald K. Ballman has been made general sales manager and L. S. Roehm has been made assistant general sales manager.

Lake Shore Engineering Co., Iron Mountain, Mich., has formed a conveyor division. Horton Conrad has been appointed to direct sales.

Swenson Evaporator Co., Harvey, Ill., has appointed George S. Edwards sales engineer for the southern territory. His headquarters will be in Birmingham, Ala.

Vulcan Iron Works, Wilkes-Barre, Pa., has appointed J. F. O'Brien as general sales manager and C. A. Netter as general purchasing agent.

E. F. Houghton & Co., Philadelphia, has established a new product development department. H. B. Walker has been named manager of the department.

Worthington Pump and Machinery Corp., Harrison, N. J., has appointed James W. Hepburn assistant manager of the vertical turbine pump division.

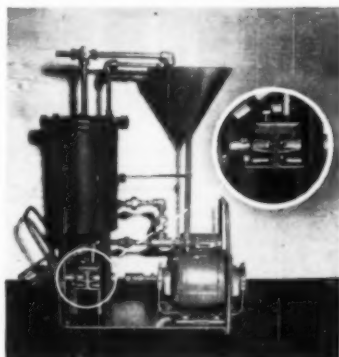
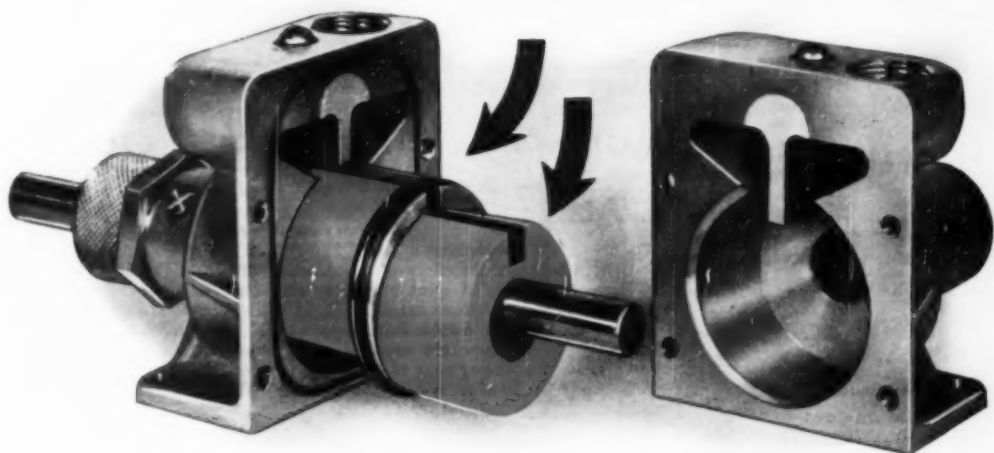
Celanese Corp. of America, New York, has arranged for three far western firms to distribute its organic chemicals on the West Coast: Mefford Chemical Co. of Los Angeles; L. H. Butcher Co. of San Francisco; and Carl F. Miller & Co. of Seattle.

Fisher Governor Co., Marshalltown, Iowa, has appointed George R. Friedrich & Co. as district sales representative in the San Francisco area.

—End

NYLON PUMP PISTONS

Resist chemical action, minimize friction



**NYLON PISTONS IN FILTER PUMP
WITHSTAND ABRASIVES**

Pumps with nylon pistons are being used in the well-known industrial filter shown above with "excellent results," according to Titeflex, Inc., the manufacturer. They have found that nylon pump pistons resist abrasion from lamp black, and other abrasive powders used as filter aids, better than any other pistons they have tried.

Impellers of Du Pont nylon plastic need no lubrication, maintain high pressure.

Another application of Du Pont nylon ... another demonstration of nylon's remarkable versatility. A manufacturer of multi-purpose pumps wanted an eccentric piston that was light, tough and resilient ... that would resist abrasion, maintain high pressure and volume, work quietly without lubrication. But the piston had to have a high degree of chemical-resistance as well ... for moving strong alkalis, weak or dilute acids, cutting oils, coolants, soap and common solvents.

Nylon did the trick

A piston machined from a rod molded of Du Pont nylon was the answer. Nylon's combination of toughness, smoothness, strength and resiliency ... even at temperature extremes ... made it the natural solution to the manufacturer's mechanical problems. And nylon met the unusual chemical-resistance specifications with equal ease.

Get this help

This is only one of many cases where Du Pont nylon has met a manufacturing

need, made a better product. When developing your new product, keep nylon's unique properties in mind ... remember it can be molded, extruded or fabricated into any desired shape. Write for free booklet on properties, uses, and working techniques. E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Main Sales Offices: 350 Fifth Ave., New York 1, N. Y.; 7 S. Dearborn St., Chicago 3, Ill.; 845 E. 60th St., Los Angeles 1, Calif.

Nylon pistons machined from rod made by The Polymer Corporation, Reading, Pa., for ECO Engineering Company, Newark, N. J., manufacturer of multi-purpose pumps.



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CONVENTION PAPER ABSTRACTS

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NUCLEONICS

... Not Just a Bomb

David E. Lilienthal

It has become the fashion in some quarters to deprecate the effectiveness of atomic weapons. A great many people have come away from the reading of a new book by a notable British scientist with this same net impression. From this waving away of the atom bomb Dr. Blackett and others

argue that the Russian position on international control is right and the American proposals—the Baruch Plan—are wrong.

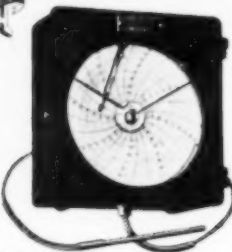
The implications of deliberately downgrading these great discoveries in atomic energy as just another weapon, and not such a remarkable one at that, are grave and far-reaching. If the view at this extreme turned out to be the correct view, it would mean a basic change in our whole treatment and development of atomic energy. It would mean that the hopeful, creative realities and potentialities would soon atrophy, and one of the greatest of all advances in human knowledge would be buried in an arsenal as a weapon and nothing but a weapon.

A further consequence of such a misapprehension would be to treat the Atomic Energy Commission of the United States as a munitions maker, to regard the civilian group at the head of the atomic energy enterprise as a kind of front for the military. It would mean that the national laboratories with their large and expensive

(Continued)

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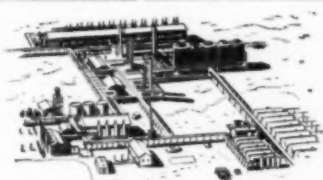
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INDICATING & RECORDING THERMOMETERS

R PRESCRIPTIONS FILLED QUICKLY AND ACCURATELY



● A complete, permanent city set up by Brown & Root on Guam Island. Constructed to meet rigid governmental requirements, this community poses every problem of construction and development. When completed, it will stand as an achievement of overall planning and competent contracting covering every phase of the operation.



● Shell Oil Company's TXL Gasoline Plant near Odessa, Texas. This is a prime example of Brown & Root's flexibility in meeting the demands of a client's changing conditions. The original contract called for a 30,000 mcf gasoline plant. During plant construction the mcf was revised to 45,000. Shortly after completion, the throughput demands were raised to 90,000 mcf . . . triple the original requirements! Foresighted planning by Brown & Root engineers allowed continuous plant operation while this tremendous project was effected.



● Spanning more than three miles of Louisiana lowlands, construction of this "Brown-Bilt" trestle required specialized equipment designed to combat the instability of swampy soil prevalent in Louisiana Roadways. Reinforced concrete, set on 675,500 linear feet of piling, assured an engineered travelway of staunch stability . . . a complete Brown & Root project fulfilling the maximum requirements of client specification.



● Offshore drilling. Derrick foundation constructed by Brown & Root Marine Operators, Inc., for a drilling operation far out in the Gulf of Mexico. "Brown-Bilt" in six fathoms of open water, its crown block towers 237 feet above the floor of the turbulent Gulf. It must withstand not only storms of hurricane strength but also the rigors of heavyweight rotary drilling operation.

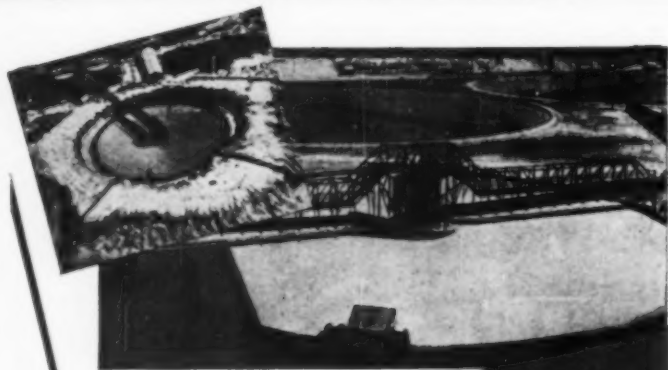


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TRADE MARK

CONVENTION PAPERS, cont. . .

equipment, the basic research program, the biological and medical studies, are really only trimming designed to disguise weaponizing and make it palatable to scientists who would not remain in an armaments program.

This is not the view held by the civilians, the scientists, technicians, and workers in today's atomic energy program. Should such a view be pressed upon them, there would be immediate and drastic changes in the personnel and character of our atomic energy enterprise.

David E. Lillenthal, U. S. Atomic Energy Commission, before University of Washington, Seattle, April 22, 1949.

MATERIALS HANDLING

. . . Conveyor Era Coming

Harold Von Thaden

If we are to protect our domestic sources of iron ore (by processing lower grade ores), provide the fuel for the rapidly-rising electrical power requirements, and, on top of this, produce synthetic fuels from coal, we will have to prepare to recover 400,000,000 more tons of iron ore annually, and better than 250,000,000 more tons of coal every year. This presents a staggering problem in bulk materials handling in the next 10 years.

The materials handling problems must be solved because only by finding better ways to increase production at lower cost can the nation maintain a constantly-increasing standard of living for its people.

Mechanization in American coal mines is proceeding at a rapid pace. While it has progressed far beyond that in other countries, only a beginning has been made. Belt conveyors will further improve the efficiency of our basic mining industries, as much as 50 percent in the next 10 years.

The ultimate goal of the mine operators and materials handling engineers is to achieve continuous flow of operation both in underground mines and in strip or aboveground mining of coal and ore.

As for strip mining, to achieve continuous flow from digging to dumping of overburden (earth, rock, trees, etc.), we must have bigger rock crushers, extendable belt conveyors and continuous diggers. Some of these devices are now being tested. We will have all of them within a few years.

Belt conveyors in the common carrier field are definitely in the cards. The recent proposal for a 130-mile belt conveyor to carry ore and coal in Ohio is as practical as it is daring.

The conveyor era is just unfolding. The possibilities appear unlimited. Belts and machinery are being constantly improved and their uses extended. Each day brings us some new application of the conveyor principle. Extending as they do into every imaginable industrial, mining and manufacturing field, conveyors offer bright, nearly unlimited careers to material handling engineers. The field is new and virtually unexplored. The potentials of conveyORIZED handling are enormous.

Harold Von Thaden, Hewitt-Robins Inc., before Society for Advancement of Management and the American Society of Mechanical Engineers, New York, April 22, 1949.

MANAGEMENT

... Five Steps

Harold G. Osborn

Until fairly recently the industrial engineer has been envisioned as an efficiency expert charged with the task of "stretching out" a job—of making an employee work harder for his regular wage. In this role he was, of course, doomed to failure. There is no expert or foreman smart enough to make a workman materially increase his productivity under the same methods, with the same tools, and for the same wage. Only economic pressure—such as a scarcity of jobs—can do that.

It is reasonable to believe, however, that the average member of the rank and file will enthusiastically embrace a plan to increase his productivity if the proper incentive is offered.

The first obstacle to overcome in the institution of a wage-incentive plan is the very human reluctance of men to work more effectively if, as a result, men are to be laid off. Whether their own jobs are in jeopardy or those of their fellows makes little difference.

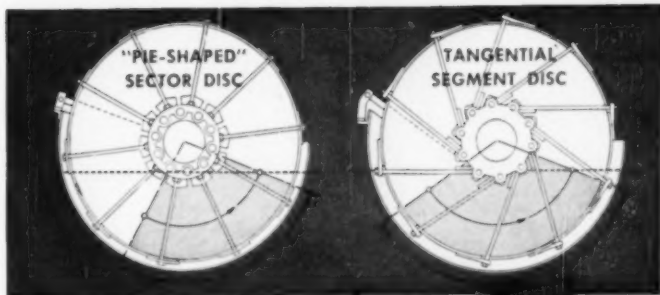
Second, productivity above the established higher level must be translated directly into increased earnings for the workman.

Third, to be workable, an industrial engineering program coupled with a wage-incentive plan must have the enthusiastic support of the line organization.

Fourth, and probably of more importance than any other one thing, is that the workmen who are expected to increase their efforts in order to increase their earnings under a wage-incentive plan be sold on the possibilities of securing the additional earning.

Fifth, there is one other basic principle of industrial engineering, whether a company is simply establishing a

(Continued)

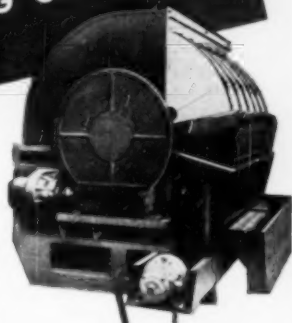


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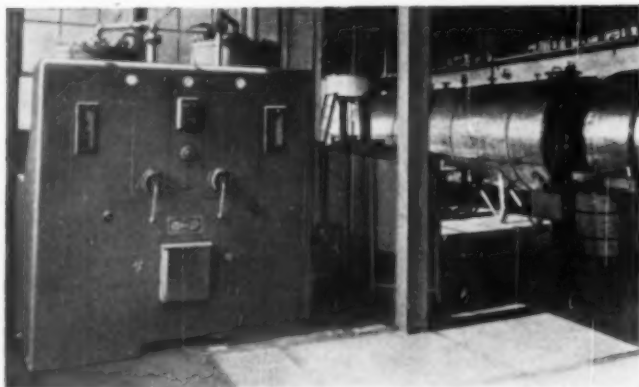
A report on the use of Dorco D-I water in pharmaceutical and cosmetic manufacture.



d-i water

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INSTALLED over three years ago, the Dorco D-I System shown above has been continuously de-ionizing water for use in the manufacture of pharmaceuticals and cosmetics. Total operating expense has averaged 13 cents per 1,000 gallons of demineralized water produced. The unit has performed exactly as specified when sold . . . and has required no resin replacement in either cell.

At Lehn & Fink, D-I water has resulted in a substantial saving where substituted for distilled water . . . has simplified product control by eliminating a variable when substituted for raw water.

This is but one case where D-I water is paying off on many counts. Regardless of industry, if your process requires water free of dissolved solids, a package or open-type Dorco D-I System will produce it . . . in any amount . . . at a fraction of the cost of distillation.



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CONVENTION PAPERS, cont. . .

new higher productive level by improvement of tools and methods, at which it expects its men to work, or is implementing the plan with a wage incentive. It is just as destructive to the industrial-engineering program to establish too low a norm under which men earn too much as it is to establish too high a one under which they earn too little.

Harold G. Onborn, Continental Oil Co., before the American Petroleum Institute's Division of Refining, Houston, Tex., April 6, 1949.

MAINTENANCE

. . . Costs

R. S. Stewart and H. A. Gustafson

Maintenance costs and methods offer fertile fields for the application of the same vision and ingenuity devoted to research and process problems. Often new or improved methods of maintenance are not fully studied or encouraged. Failure to use adequate and sufficient tools is a frequent fault. Failure to use trained engineers in the maintenance field is a handicap. The progress and development of maintenance research and analysis have not kept abreast of the emphasis placed on the process side.

Benefits from improved maintenance are many. The productivity of the worker increases. Shutdowns and turnarounds are shorter and less frequent. Output increases. Repairs last longer. Equipment operates efficiently. By using existing equipment a larger percentage of the time and of capital expenditures for expanded capacity is conserved. These are some of the advantages of better maintenance. They save money. They reduce the cost of plant operation. They apply to both small and large plants.

Recognizing the potentialities of better maintenance methods in ultimately reducing costs and conserving capital, the Standard Oil Co. (Ohio), in common with other oil companies, developed a program to control maintenance costs. In outline, the program consists of two broad phases. The first requires accurate and current cost figures. This meant revising and adapting our refinery accounting methods to supply maintenance information. Such statistics are necessary in a convenient form for analysis and decisive action. The second phase involves initiating modern industrial engineering practices.

We do not use the word "control" in a sense of coercion or rigid regulation. Rather, the controls we propose serve to guide and direct man-

agement to correct impressions, decisions and actions. Controls of this type stimulate unity of effort. They promote the enthusiastic aid of all management levels in the solution of maintenance problems.

R. S. Stewart and H. A. Gustafson, Standard Oil Co. (Ohio), before 14th Midyear Meeting, American Petroleum Institute, Houston, Apr. 4-7, 1949.

PLASTICS

... Low Pressure Molding

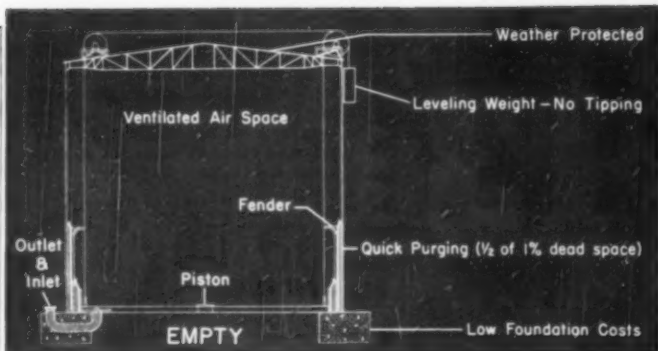
J. H. Wyckoff

The low pressure molding industry has developed by making use of the most obvious and superficial working properties of the polyester-monomer and allyl resins, which has given rise to an over-simplified conception of how and why they function. After at least eight years this misnamed industry is still in a state of immaturity that does not indicate its future, for almost everywhere the solution to production problems is sought empirically. This trial and error method does not provide sufficient information for an easy solution to the next problem, so it is therefore wise to review our collection of apparently unrelated facts and attempt to fit them into a pattern of integrated knowledge.

The best approach to the understanding of any problem is to first define it and then proceed to examine it within the limits of the definition. Since the use of the word "low" is ambiguous it is simpler to ignore the question of how much pressure and be concerned only with the type of pressure. Thus, the industry has three methods of proceeding, namely: (1) no pressure, (2) fluid pressure, (3) positive pressure.

The third method using positive pressure is the least developed, and the most promising. In order to apply positive pressure to these materials new concepts of tooling must be created that differ considerably in design from the tooling and molds used for the normal transfer or compression molding. With the correct mold design the idiosyncrasies of the raw materials are least felt, the variables being assigned to the tooling rather than to the operative skill. Better properties in the molded part are obtained, for there is evidence that the reaction has been considerably extended. At the present time only a few operations use this positive pressure method, and they are conspicuously successful because of their high speed low cost production, and successful competition with well established compression and injection molding practices. It is safe

(Continued)



WIGGINS GASHOLDER

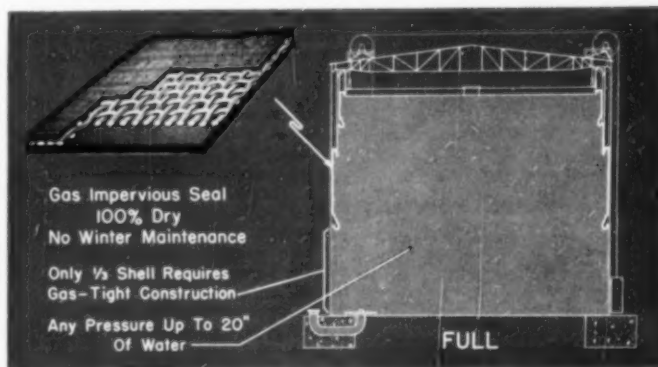
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EVERLASTING FASTENINGS

CONVENTION PAPERS, CONT.

to say that in view of recent engineering developments, many applications of the high compression and injection molding resins will be replaced by the polyester modified resins on an economic basis alone.

J. H. Wyckoff, American Cyanamid Co., before the Society of the Plastics Industry, Santa Barbara, Calif., March 17-19, 1949.

RESEARCH

. . . Bureau of Mines

James Boyd

The Bureau of Mines has recognized and accepted the responsibilities that fall within its own jurisdiction. It has sought to acquire and publish meaningful data, and to do so with the foreknowledge that the information is needed and will be used. Whether in mining or metallurgy, explosives or safety, statistics or economics, research of all types is a primary adjunct to the mechanism of the bureau.

This leads us to six specific differences between bureau and private research.

1. The bureau strives to emphasize fundamental research and background research rather than applied research and development. The latter are ordinarily functions of industry and privately-endowed research institutions. However, the bureau was established by the Congress as a technical agency and was given the duty of conducting scientific and technologic investigations designed, among other things, to increase the efficiency and economic development of mining, quarrying, metallurgical and other mineral industries. As such, it finds it necessary in many instances to supplement the applied research and development carried out by private enterprise as well as engage in fundamental and background research.

2. The federal organization should direct its work toward the development of a major resource and rarely, if ever, toward a particular property which normally should be developed by private enterprise.

3. Although both industry and government research serve the public interest, the profit motive obviously must predominate in any investigations conducted by industry, whereas government research need not necessarily be oriented to immediate economic objectives or be confined to them.

4. Research by the federal agency should be geared, as a rule, to long-range problems; as a rule, industry

(Continued)

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- For Major Chemical Reaction
- For Homogeneity



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Without Cavitation**

Assure most intimate contact of chemicals and liquid for immediate and complete chemical reaction.

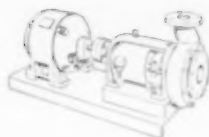
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PROQUIP



3 Reasons why I-R Chemical Pumps will give you Better Service

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**They are ARMORED
AGAINST CORROSION**
—with **IRCAMET**

Ingersoll-Rand chemical pumps are built to stand up under the continuous handling of corrosive and abrasive liquids. All parts of the pump that come in contact with the liquid are made of IRCAMET—a high nickel-chromium-molybdenum alloy steel developed exclusively by I-R for chemical pump service. Laboratory tests and years of field experience have proved its exceptional ability to resist the corrosive action of a wide variety of acids and alkalis. Other materials are available for special operating conditions. The entire unit is further protected against corrosion by special paint which is highly resistant to chemical action.

2

**They are PROTECTED
AGAINST LEAKAGE**
—with the **LEAKCOLLECTOR**

The patented LEAKCOLLECTOR stuffing-box gland—an exclusive feature of all I-R chemical pumps—provides a simple and effective solution to the problem of pump leakage.

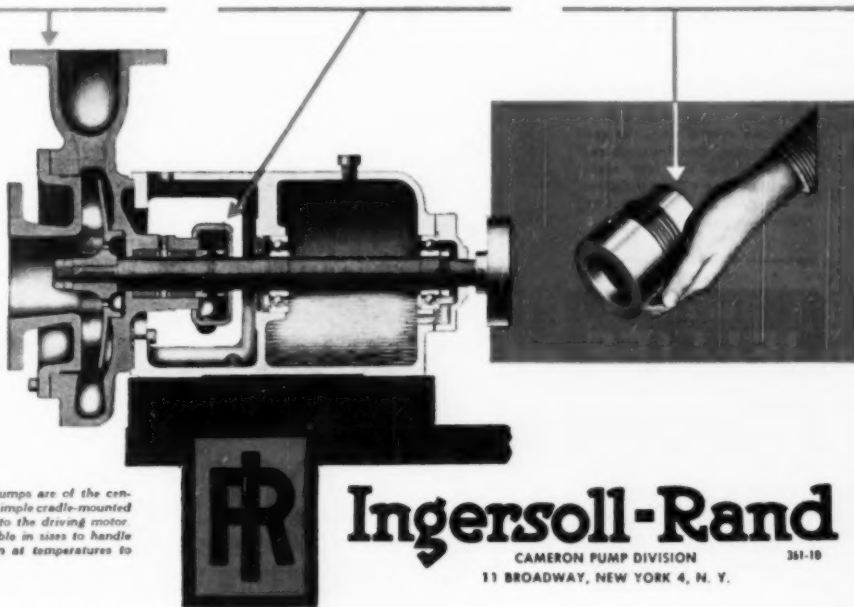
It completely encircles the stuffing box, trapping all leakage so that it can be drained away for collection or disposal. The split gland is accurately fitted to both the inside and outside of the box, and will catch any seepage escaping between the shaft and packing, or between the packing and the bore of the box. The LEAKCOLLECTOR is easily removed from the shaft for repacking the box.

3

**They are BUILT FOR
EASY MAINTENANCE**
—and **LESS OF IT**

These pumps are ruggedly constructed to last longer on the job—and the simple design, with all parts easily accessible, means less "time out" for maintenance. The short, rigid stainless-steel shaft prevents impeller whip and eliminates many stuffing box troubles. The suction nozzle is removable, permitting access to the impeller without disturbing the discharge piping.

THE CAMERON SHAFT SEAL can be installed on all I-R chemical pumps to replace the conventional stuffing-box packing. It eliminates stuffing-box leakage and requires practically no attention or maintenance.



I-R Chemical Pumps are of the centrifugal type, of simple cradle-mounted design, coupled to the driving motor. They are available in sizes to handle up to 4000 gpm at temperatures to 600° F.

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Our holes are spaces bounded by metal. The metal may be woven wire, or it may be electro-deposited as LEXTROMESH. Our smallest commercial woven-metal holes have an area of about 0.0000841 square inches, and there are 5,760,000 of them to the square foot. In LEXTROMESH we make more than 23,000,000 to the square foot as a matter of course.

We weave 200 x 200 mesh in square weaves and 50 x 750 in Dutch Twilled. LEXTROMESH as fine as 400 x 400 is a standard item.

Some folks are very fussy about hole sizes. Our run-of-the-mill holes have a reputation for being uniform enough for almost anybody, and on special request we go way beyond US Bureau of Standards requirements.

We've had a lot of experience in making special holes for special purposes. Our Research and Service people just love tough problems. They will be delighted to help you, too, at any time. Write to Department 15.



CONVENTION PAPERS, cont. . .

cannot anticipate requirements too far in advance.

5. Private enterprise envisions action on a local scale or within its own trade province. A federal bureau must function nationally with the primary objective of benefitting all citizens.

6. Many aspects of national defense and similar non-commercial problems are not within the province of industry. Research of this type, especially when secrecy is essential, is obviously a function of government, except where it is specifically assigned to industry under specialized conditions.

James Boyd, U. S. Bureau of Mines, before the Colorado Mining Association, Denver, Feb. 2, 1949.

DISTILLATION

. . . Compression Distillation

E. T. Erickson

In an effort to improve distillation multiple effect stills were developed years ago to increase the yield or the amount of distilled water produced per unit of heat or energy.

Now, many years ago, it was proved mathematically possible to achieve even greater yields from a distillation

process that was first described as regenerative evaporation, then later as vapor recompression or thermo compression, then vapor compression distillation, and currently is described as "compression distillation."

Precisely, what do we mean by "Compression Distillation?" Let us follow the development given in 1921 by W. L. Badger.

"Imagine a simple evaporating device, with liquid boiling in it at atmospheric pressure. Also assume that it is heated by steam at 10 lb. gage (240 deg. F.), that no heat is lost in heating feed, in radiation or in any thick liquor drawn off, and that the condensate leaves at the temperature of the boiling liquid. To evaporate 1 lb. of water will take 970.4 Btu. and 1 lb. of steam will give up 980.4 Btu. A very slight change in our fundamental assumptions will make the two exactly equal. Then, what is happening really comes down to converting 1 lb. of steam at 240 deg. and 10 lb. gage to 1 lb. of steam at 212 deg. and atmospheric pressure.

"Now if the hot condensed water is returned to the boiler without loss, we will have to add 980.4 Btu. to regenerate a pound of heating steam. But the pound of atmospheric vapor formed contains 970.4 Btu.'s more (Continued)

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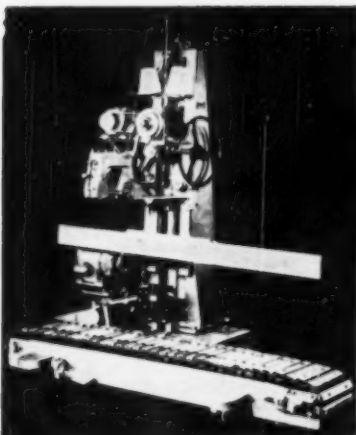
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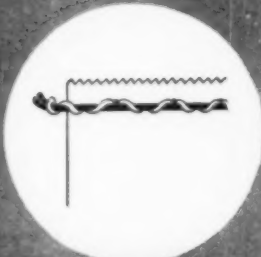
Screw Products Co., Inc.

33 GREENE STREET, NEW YORK 13, N. Y.

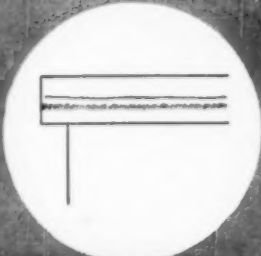
STAINLESS STEEL
FASTENERS



MODEL "E 1" (portable)—one operator can close up to 15 filled bags per minute. A single foot pedal controls both conveyor and sewing head. Handles both paper and textile bags.



ALL BAGPAKERS MAKE THIS FAMOUS "CUSHION-STITCH"



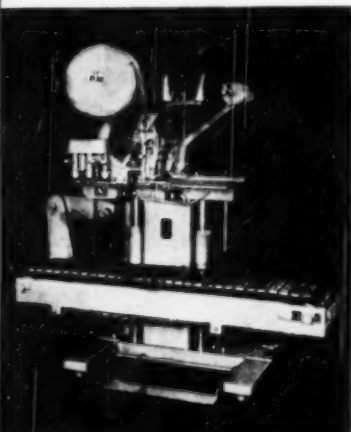
TAPED CLOSURE IS MOISTURE RESISTANT—SIFT PROOF—TOUGH
Taped closure is effected on Model "DA"

Strong, Tough Closures

—mass produced!

Mechanize your closing of heavy-duty, multiwall paper bags, with BAGPAKERS.[®] You swing into production line speed—up to 15 bags per minute. BAGPAKERS apply famous "cushion-

stitch" closure that absorbs strains and won't pull out. When sealed with strong BAGPAKER tape, the "cushion-stitch" closure is moisture-resistant, contamination-proof and sift-proof.



MODEL "DA" (portable) applies taped "cushion-stitch" closure. One operator, filling and closing, can handle 2 to 4 bags a minute... 6 to 12 where filled bags are delivered to BAGPAKER conveyor. Sewing operation starts and stops automatically—no tape wasted.

Talk over your closing and handling methods... your multiwall paper bag requirements, with a BAGPAK engineer. He knows ways to speed operations and cut costs.

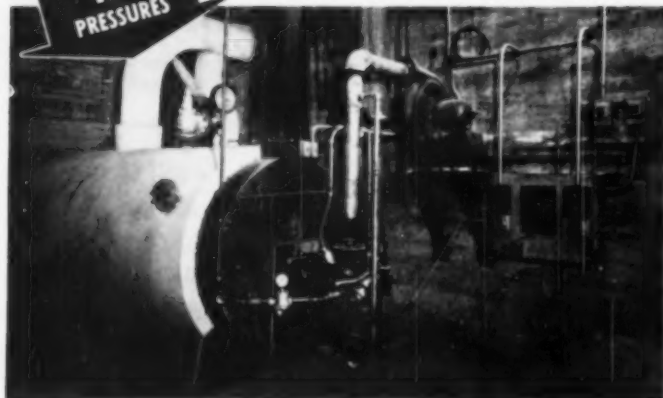


INTERNATIONAL PAPER COMPANY, Bagpak Division • 220 East 42nd Street, New York 17
BRANCH OFFICES: Atlanta, Baltimore, Boston, Chicago, Cleveland, Joplin, Mo., Los Angeles, New Orleans, Philadelphia, Pittsburgh, St. Louis, San Francisco. IN CANADA: Continental Paper Products, Ltd., Montreal, Ottawa.

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**NEW HORIZONTAL
Dowtherm Vaporizer**

HIGH
TEMPERATURES
at
LOW
PRESSURES



Twelve years ago we designed and built a 600,000 BTU Horizontal Dowtherm Vaporizer. This Vaporizer has been in almost constant operation since that time at temperatures sometimes as high as 700°F. Since that time, new designs have been

developed and two years ago we built three 1,500,000 BTU Horizontal Dowtherm Vaporizers, one of which is shown in the photograph above. All of these have given remarkable service, so we are now ready to produce horizontal units for the market.

**the CHIEF ADVANTAGES of the
New McKee Horizontal Dowtherm Vaporizer are:**

- 1 Low liquid level which facilitates the gravity return of condensate from heat-using equipment.
- 2 All heating surfaces below liquid level, meaning greater economy.
- 3 Combustion within the vaporizer itself, so there is no heat loss through a furnace wall.
- 4 No flat surface with heat on the other side, on which a deposit can form and build up.

These are only a few of the advantages of this new unit and we invite your inquiries. Sizes from 300,000 BTU up through 2,000,000 BTU for temperatures up to 650°F. Write for information.

Eclipse Fuel Engineering Company
ROCKFORD ILLINOIS

**McKee
Eclipse**

CONVENTION PAPERS, cont. . .

than the condensate. Why not, then, merely add 10 Btu. by compressing the steam instead of 980 to raise more steam? By this line of reasoning many times as much evaporation could be obtained per pound of coal burned than by raising steam direct, even after allowing for all kinds of losses."

The vapor compression distillation unit consists essentially of four pieces of equipment: (1) still, (2) vapor compressor, (3) power unit, (4) heat exchangers.

Still—This is a vertical evaporator of the film type. The normal water level is usually one-third up the tubes. Any liquid in the steam is returned to the bottom of the still by external downcomers. After the generated steam is compressed, it is discharged into the steam chest of the still. Here the compressed steam gives up its latent heat of vaporization to the water fed into the still and is condensed to form the distillate.

Compressor—This is a vapor compressor of special design to take the generated steam at atmospheric pressure and discharge it back into the still at a higher pressure and a correspondingly higher temperature.

Power Unit—This unit supplies the power to drive the vapor compressor and will supply the additional energy necessary to operate the still. The power unit may consist of an electric motor, steam turbine, diesel or gas engine or the like.

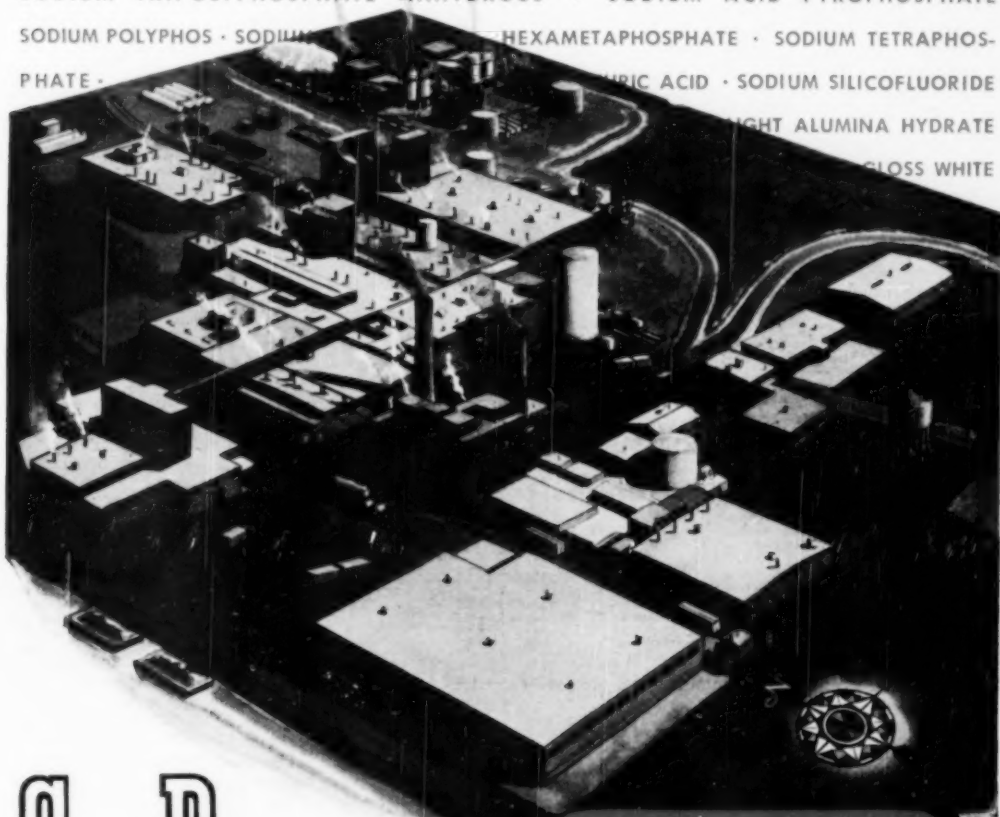
Heat Exchangers—In general, these are conventional throughout. The feedwater is increased in temperature by the outgoing distillate and by the blowdown. The vent condenser discharges the non-condensable gases to the atmosphere.

The compression distillation still is closely related to the "heat pump" in the principle of recycling the latent heat of vaporization. We may think of this still as a device for putting in just enough heat to convert the liquid phase to the gas phase and then for allowing this gas phase to give up the latent heat of vaporization to the liquid phase in order to achieve the rebolil principle.

The recycling of the latent heat, of course, eliminates the necessity of direct fired equipment. We all know to operate single and multiple effect stills, a boiler plant of some sort is required to introduce heat into the system. The recycling of latent heat eliminates the necessity of direct feed equipment, thus a boiler plant is not required to operate a compression distillation still.

By recycling the latent heat of vaporization a remarkable fuel econ-

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 SODIUM TRIPOLYPHOSPHATE ANHYDROUS • SODIUM ACID PYROPHOSPHATE
 SODIUM POLYPHOS • SODIUM HEXAMETAPHOSPHATE • SODIUM TETRAPHOS-
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 EIGHT ALUMINA HYDRATE
 GLOSS WHITE



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From the Blockson plant (pictured above) shipments of Sodium Phosphates are made daily—bound for all principal production centers of the nation.

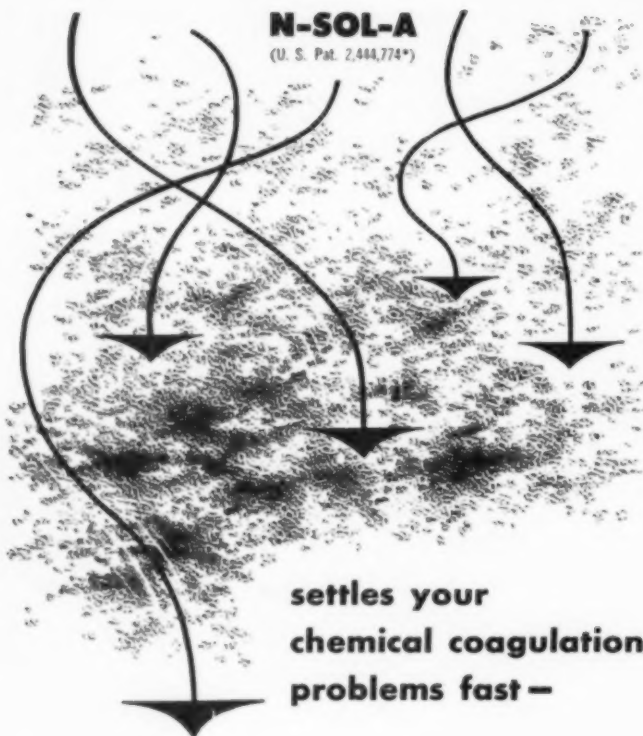
They go directly to supply manufacturers and processors in scores of industries and to replenish stocks of strategically located Blockson distributors.

Blockson Chemical Co. • Joliet, Illinois

BLOCKSON

Sodium Phosphates
 FIRST AND FOREMOST

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Here's a quick way to settle impurities, organic matter etc. in industrial raw and waste water supplies. Coagulate with N-Sol (activated silica sol).

Activated silica sol, conveniently made by a N-Sol Process, and used with a coagulant such as alum or iron salts, speeds clarification. The larger, denser flocs which are formed enmesh the suspended solids better and settle faster.

You see the results in—Better color removal ... Better quality water ... Shorter settling time ... Increased filter capacity ... Reduced chemical costs.

N-Sol-A Process of water treatment is standard practice in many municipal and industrial water plants†. Let the flexible, versatile N-Sol solve a raw water or waste water treatment problem for you.

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*N-Sol Processes for reacting "N" & sodium silicate with various acid-functioning chemicals are licensed without charge. Request free samples of "N" silicate for jar tests and further details.

†Names on request

*Phila. Quartz Co.

CONVENTION PAPERS, cont. . .

omy is shown over other types of distillation equipment. A single effect still produces 14 lb. of distilled water for 1 lb. of fuel. A triple effect still gives 36 lb. of distilled water for 1 lb. of fuel. A compression distillation still gives 200 lb. of distillate for 1 lb. of fuel. In other words, a compression distillation still produces 54 times more distillate per unit of fuel than does the triple effect evaporator. More directly stated, a vapor compression still corresponds to a fourteen effect evaporator.

E. T. Erickson, Erickson Chemical Co., before Midwest Power Conference, Chicago, April 12, 1945.

PLASTICS

... Calendering and Sheetting

R. F. Dettelbach

*Vinyl resins were calendered into film and sheeting before World War II but the progress since the latter part of this period is worthy of note.

Approximately two years ago a trend began which enabled film and sheeting to take on a new meaning. It became apparent that these materials could be dressed up. This trend gained momentum and during this last year we have seen the development of styling and end-product use coupled with quality and customer appeal to a degree none of us foresaw. These products have been identified, even if unknowingly, as a new textile material. Four gage film has supplanted "King Cotton" in many uses and it very probably will in more.

1948 saw 150,000,000 yards of light film and 50,000,000 yards of sheeting sold. Some of our newer developments seem to indicate the packaging possibilities and, if so, we have in this one field alone, an immense potential. Vinyls are making larger inroads into automotive upholstery, floor tiling, linoleum, and, in addition, rigid sheeting will also play its part in the total polyvinyl picture.

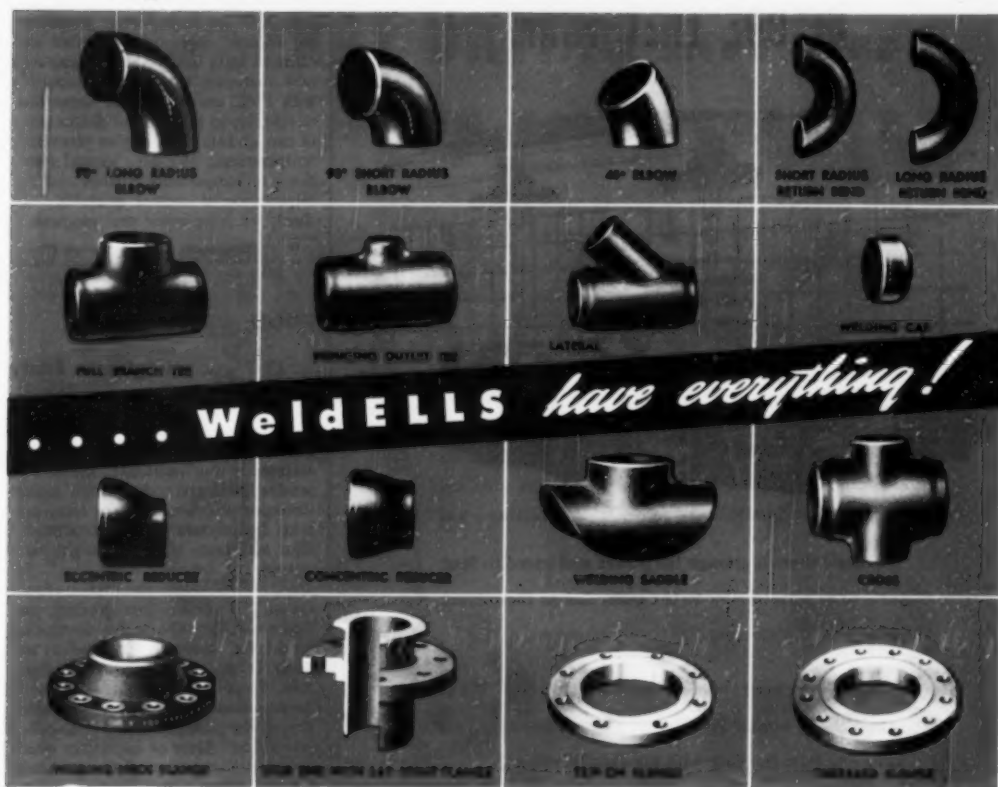
It appears that our over-all objectives must not be overlooked or dropped because of any economic scramble if we are going to give these unfinished materials a chance to go into all the end uses which now seem so close.

A few unsolved problems are:

(1) Perfect plasticization of vinyl materials; (2) the ideal material or combination of materials which will stabilize the plasticizer or plasticizer blend; (3) the most perfect colors; (4) equipment to best process these vinyl materials.

(Continued)

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Whatever the conditions: Extreme temperatures . . . extreme pressures . . . steady flow or shock service . . . corrosion resistance . . . product purity.

Whatever the material: Forged carbon steel . . . wrought iron . . . carbon or chrome moly . . . Stainless 304, 347, 316 . . . Monel . . . Nickel . . . Inconel . . . Aluminum . . . other usual industrial materials.

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Whatever your requirement: Taylor Forge provides the most complete line. Accept no less!

TAYLOR FORGE

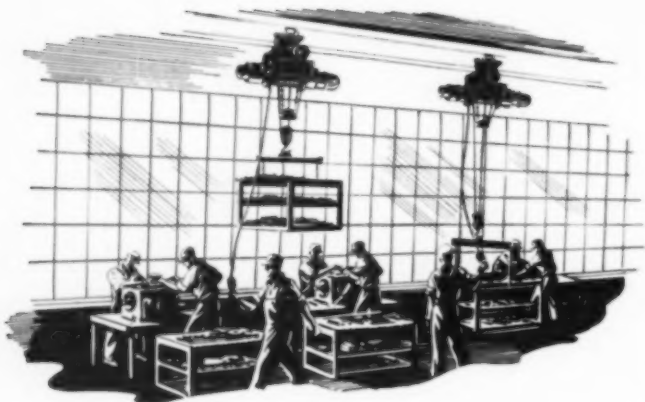
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Makes and sells all three lifting
tools for airborne shop loads.



382 SCHUYLER AVENUE • MONTAUR FALLS, N. Y.

CONVENTION PAPERS, cont. . .

In rebuttal, we have made certain progress in progressively better and more uniform resins, better plasticizers for specific uses, nitrile rubber and resinous type, to name two, discovered new materials which are compatible with PVC and we at least know how to stabilize so that we can obtain some of the advantages of higher processing temperatures. We have learned something of temperature balance and the importance of control generally. In short, we have made real progress.

R. F. Dettelbach, R. F. Goodrich Chemical Co., before Society of Plastics Industry (Canada), Feb. 13, 1945.

FOOD

. . . Glutamic Facts

E. H. Hungerford

Early descriptions of monosodium glutamate as a food seasoning usually ascribed to it a "meat like" flavor. The product produced commercially at that time probably was not free from protein hydrolyzate, the characteristic odor and taste of which might conceivably be termed "meat like." Indeed, when used in certain foods (soups) even the pure product produces a flavor which the description "meat like" seems to fit as well as any other. It has been found that the desirable flavor enhancing properties of monosodium glutamate are characteristic of the pure product. The so-called "meat like" flavor of impurities which sometimes accompanied the glutamate detracts rather than adds to the pleasing effect. These and other facts have led to new explanations of the action of monosodium glutamate as a seasoning.

According to Cairncross who has investigated extensively the role of monosodium glutamate in food flavoring, the substance in pure form has only a sweet saline taste accompanied by some astringency. It has, according to him, a notable effect on food flavor by blending and rounding out without itself contributing any noticeable odor or taste. True meat flavor is predominantly odor and since monosodium glutamate is odorless, the "meat like" flavor cannot be due to or reproducible by monosodium glutamate. In general, he found that monosodium glutamate added in small amounts, 0.1 to 0.3 percent, had a pronounced effect on the flavor of practically all foods without itself being very noticeable. It even had an effect on the aroma of foods, although possessing none itself. So-called flavor appeal was enhanced, most notably in meats, seafood, stews,

(Continued)

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But, frankly, our Swenson engineers are somewhat amazed at the number and variety of applications where spray drying seems to provide a long-sought answer. It converts solutions or suspensions directly to dried product in a matter of seconds—ready for packaging—without any other processing steps.



This new
Bulletin D-105
tells the story
concisely.

We invite you to
write for a copy.



SWENSON EVAPORATOR CO. DIVISION OF WHITING CORPORATION

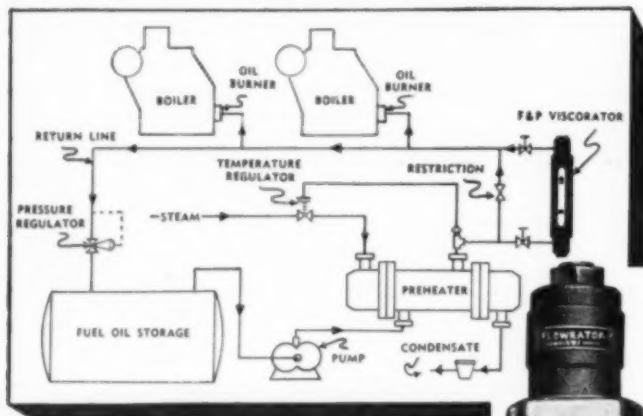
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IMPROVE BOILER EFFICIENCY WITH FUEL-OIL VISCOSITY CONTROL

New method continuously and automatically indicates, records, and controls viscosity



PROBLEM: To maintain uniform firing conditions and peak oil-burner efficiency, in spite of fuel-oil viscosity variations. When fuel-oil viscosity is too high, flow rate, degree of atomization, and combustion efficiency will vary.

SOLUTION: Measure and control fuel-oil viscosity continuously. Specify the VISCORATOR Instrument. This unit, calibrated in Saybolt Universal or Furol Seconds, measures viscosity continuously, and shows, at a glance, how "thick" the oil is.

RESULT: Uniform fuel-oil viscosity greatly increases the efficiency of the burner. In addition, fuel-oil savings alone pay for the VISCORATOR Instrument within a few months.

Write for Catalog 88 for complete data.

FLOWRATOR
TRADE MARK



FISCHER & PORTER CO.
Dept. 9R-9B Hatboro, Pa.

INSTRUMENTS FOR FLOW RATE MEASUREMENT
AND AUTOMATIC FLOW CONTROL

CONVENTION PAPERS, CONT. . .

soups and chowders. Cooked vegetables were improved.

It is unnecessary to tell food processors how to use monosodium glutamate in products on which it is applicable. They, in general, work out experimentally the proper combination of foods with condiments and flavors to give the desired taste effect. For housewives it is usually simple and effective to explain that monosodium glutamate is used about as salt is used and in about the same quantity. Similarly, with monosodium glutamate, enough is added to blend and round out the flavor but excesses are avoided. Home use of monosodium glutamate often includes its use on foods where it is not outstandingly successful but where it adds sufficient zests to an otherwise drab food to attract the interest of small children who often have diabolical aversions to eating what is good for them.

In general, the use of monosodium glutamate is more effective in foods of approximately neutral pH. The glutamate flavor, or glutamate effect, is greatly reduced in foods of higher acidity.

E. H. Hungerford, International Minerals and Chemical Corp., before the Western Chemical Market Research Group, San Francisco, Mar. 3, 1949.

RESEARCH

. . . Grants in Aid

Joseph W. Barker

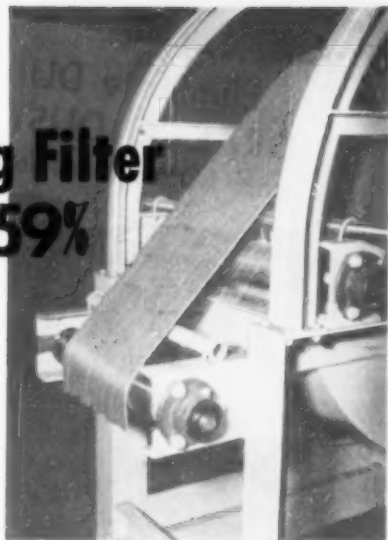
Research Corporation was organized in 1912 with the gift to it of valuable patent rights in the field of electrical precipitation by the late Dr. Frederick Gardner Cottrell and his associates. It is a completely non-profit organization. Its entire net earnings can only be expended by grants in aid of scientific research and investigations in our educational and scientific institutions. Over the years since 1912 it has built a business organization which manufactures and installs Cottrell electrical precipitators as used in many technological industries. During these years it has been the recipient of other valuable patent rights from which it receives additional income. From the net earnings the board of directors makes appropriations for grants in aid of research and from time to time for awards to outstanding scientific research men.

It has accumulated from earnings a nest-egg of approximately \$5 million with the concept of continuing our program of grants in aid as well as in good business times. It has presently
(Continued)

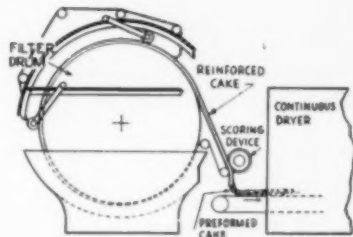
68% moisture in the
filter cake was too high —

So a FEinc String Filter Got it Down to 59%

An ordinary rotary vacuum filter on an iron pigment couldn't go lower than 68% cake moisture—too "sloppy" to be dried in a continuous dryer—so a FEinc String Filter with FEinc Compression dewatering was tried. Now containing not more than 59% moisture, the cake is firm, easily handled by the dryer. Here's how the FEinc filter did it:



- 1 FEinc STRING DISCHARGE LIFTS THE CAKE. The cake is built up over endless strings which pick the cake off the cloth in one continuous sheet.
- 2 FEinc STRING DISCHARGE ELIMINATES BLOW-BACK. In the previous scraper type filter, the cake was loosened by compressed air which couldn't help blowing some of the filtrate back into the cake from the drain lines.
- 3 FEinc GETS CAKES DRYER BY COMPRESSION. Exclusive compression mechanism squeezes the cake, closes up cracks, prevents "short circuiting" of vacuum. Saves 5 to 25 hp. on vacuum requirements.
- 4 FILTER CLOTH LASTS LONGER, TOO. There's no scraping wear, no "blinding." And because there's no wire winding, you save hours in changing time.



*Adaptable to
Continuous Dryer*

Any combination of FEinc features can be built to make your tough filtering, washing, drying, and cake handling seem easy. More details in free Bulletin 101—have you your own copy?

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Dust, even in small amounts, has a direct bearing on production costs. Dust has never been known to contribute to efficient operation — on the other hand DRACCO Dust Control ALWAYS saves money in several ways. DRACCO Dust Control creates better working conditions that attract the best workers, prolongs useful life of equipment, this reduces maintenance cost and the time equipment is down. General plant efficiency is increased and this naturally leads to LOWER COSTS. DRACCO Engineers have over 30 years experience in dust and fume control — why not consult them?

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DUST CONTROL EQUIPMENT

PNEUMATIC CONVEYORS • METAL FABRICATION

CONVENTION PAPERS, CONT. . .

available for current and future grants through appropriations already made by the board the sum of approximately \$2.3 million. We are supporting research programs in some three hundred colleges and universities at the annual rate of about \$1.25 million. We are an outstanding example of fostering research through the earnings of research. Our only mission and the sole reason for our tax-exempt existence is to help the colleges and universities build adequate research staffs and to carry significant research programs which will make contributions to the sum total of human knowledge.

Although we manage a great many patents for educational institutions and although we make our income from patents, no grant from Research Corporation carries any strings of any type. Should patentable results come from the work under any of our grants, the inventor and his institution have complete control over what they wish to do with the patents or with the proceeds therefrom. Many of them do turn to us and say in effect—"We know nothing about managing patents, it is not our business to handle them, it is your business and will you undertake to manage these patents for us." We have many such agreements from which the inventor gets a share, the institution gets a share and our share, after we have paid expenses on the patent management, goes into our general funds, there to be used only for the promotion of more research. That is a very brief statement of who and what we are.

Joseph W. Barker, Research Corp., at presentation of Research Corp. Scientific Award, Salt Lake City, Feb. 10, 1949.

DETERGENTS

. . . Markets

R. M. Prather

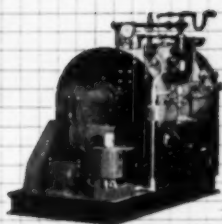
"Soap substitutes" embrace synthetic detergents selling at relatively low prices, moving in large volume, and representing perhaps two-thirds to three-quarters of all synthetic surface active agents produced. The group comprises sulphated lauryl alcohol and sulphated monoglycerides, both derived from vegetable oil raw material; and sulphonated alkylated aromatics and sulphonated straight-chain hydrocarbons, both based on petroleum raw materials. As marketed these synthetic detergents are rarely one hundred percent active organic compound. Usually they contain around 35 to 40 percent active or-

(Continued)

LITTLE GEM ➡

or

BIG BEAUTY



Select to meet your space and steam requirements from the wide range of sizes of Cleaver-Brooks Engineered Steam Generators.

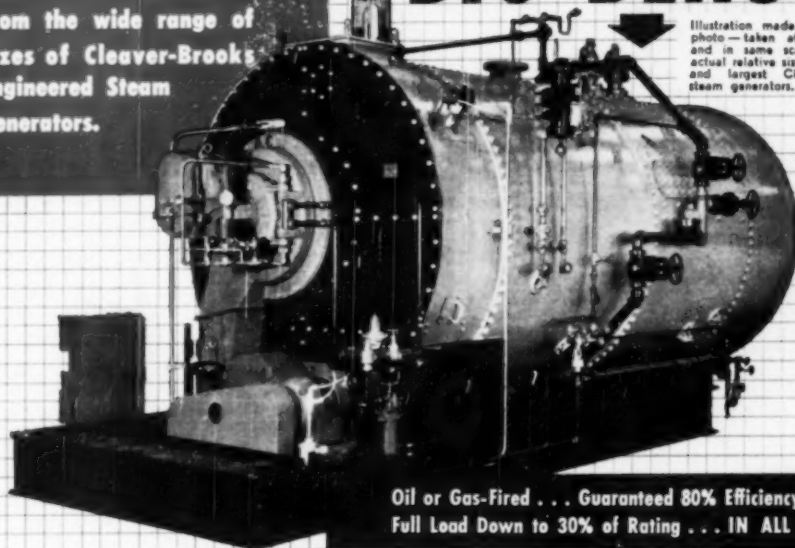


Illustration made from actual photo—taken at same time and in same scale—showing actual relative sizes of smallest and largest Cleaver-Brooks steam generators.

Oil or Gas-Fired . . . Guaranteed 80% Efficiency from Full Load Down to 30% of Rating . . . IN ALL SIZES

WHY search and "shop" for a boiler—install a Cleaver-Brooks engineered and packaged steam generator that fully meets your steam requirements and needs only a minimum of space and headroom.

You can select from a range of sizes 15 to 500 hp.—and you can have your Cleaver-Brooks steam generator equipped for oil, gas, or with a combination burner which permits alternate use of gas or oil and provides for a quick change-over from one fuel to the other.

Equally important—you get Cleaver-Brooks guarantee of at least 80% efficiency from full

load down to 30% of rating—with either gas or oil as fuel—and IN ALL SIZES.

Cleaver-Brooks steam generators enable you to burn the available fuel in your area—give you clean, smokeless operation—eliminate fuel and ash handling—need no high or costly stacks—no special foundations—fit under low headroom and into limited space—provide flexible operation to meet fluctuating loads—fully meet all codes.

Available in a size to fit your needs—15 to 200 p.s.i., 15 to 500 hp.—write for Cleaver-Brooks Steam Generator bulletin.



CLEAVER-BROOKS COMPANY, 339 E. Keefe Ave., Milwaukee 12, Wis.

Cleaver-Brooks

"Packaged" STEAM GENERATORS

HAVE SERVED INDUSTRY FOR MORE THAN FIFTEEN YEARS

WRITE on your business letterhead for Free Steam Cost Calculator—a ready reference slide rule showing the comparative steam costs when using oil, gas or coal as fuel.



**PREFERRED
ON ALL COUNTS...**

CESCO's IMPROVED Acitex APRONS AND SLEEVES...

• CESCO's famous *Acitex* offers more effective resistance to a greater number of acids, caustics and splashing liquids than other adaptable material.

Research and laboratory testing proved *Acitex*'s usefulness for aprons and sleeves. On-the-job tests proved its adaptability, versatility and value.



ACID RESISTANT
Acitex resists caustics, splashing liquids and injurious acids—such as nitric, sulphuric, hydrochloric, acetic, hydrofluoric, carbolic.

COMFORTABLE
Light weight, cool and comfortable to wear. Easily adjusted *Acitex* straps for attractive fit on every wearer.



EXTREMELY TOUGH
High abrasion resistance. Electronically welded seams and double-thick *Acitex* grommets. No metal parts.

ECONOMICAL
Moderate cost plus durability for real economy. Important dollar savings in injury prevention.



Write for a copy of the latest CESCO Catalog!

CHICAGO EYE SHIELD COMPANY
2342 Warren Boulevard
Chicago 12, Illinois



Estimated Production of Finished Synthetic Detergents by Type

	Millions of Pounds				
	Sulphated Lauryl Alcohol	Sulphated Mono-Glyceride	Petroleum Sulphonates	Alkyl Aryl Sulphonates	Total
1944	35	25	25	70	155
1945	70	30	25	90	215
1946	110	45	30	115	300
1947	200	45	35	135	415
1948	200	50	40	300	590

CONVENTION PAPERS, CONT.

gamic ingredient, which is extended with inorganic salts to give the desired chemical and physical properties to the finished product. These four products are generally competitive among themselves, all filling more or less the same uses and selling at competitive prices.

As to physical form, they are available as white or ivory solids either in thin, dense flakes resulting from drum drying operations or as light, spherical beads from spray drying. They are also obtainable as pastes of various consistencies, thin slurries, and as complete water solutions.

Of the 1948 detergent production, probably two-thirds (400 million pounds) will go from producer to the household market, reaching the housewife either as a light duty product for fine fabrics and dishes, such as Dreft, Vel and Swerl, competitive with "fine" soaps like Ivory Snow and Lux Flakes.

Or as a heavy duty, general purpose washing machine product such as Tide, Fab and Surf, which are synthetic detergent-phosphate mixes corresponding to heavy duty packaged soaps such as Duz, Rinso and Super-Suds. As to the over-all position of detergents vs. soap in the household market indications are that detergent sales as a percentage of total packaged soap products range from 10 percent in soft water areas up to 50 percent in areas having hard water.

Of the 200 million pounds of detergents going into the industrial field in 1948, probably the large part will be consumed in textile dyeing and finishing and in manufacture of cleaning compounds, such as dairy cleaners, automobile washes, packing plant cleaners and proprietary scouring and cleaning preparations for household use.

Robert M. Prather, Indol Chemical Co., before Chemical Market Research Association, Philadelphia, Feb. 10, 1949.

—End



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• Cole has specialized in the design, fabrication, and erection of elevated tanks for four generations. This long experience enables us to handle your assignment with dispatch, and to your complete satisfaction.

Cole builds tanks, towers, vessels, cylinders, bins, etc., to your specifications—any size, any shape, any metal. Send us your inquiries. Write for catalog—"Tank Talk."

R.D. COLE

MANUFACTURING CO.
NEWNAN, GA.

Established 1854



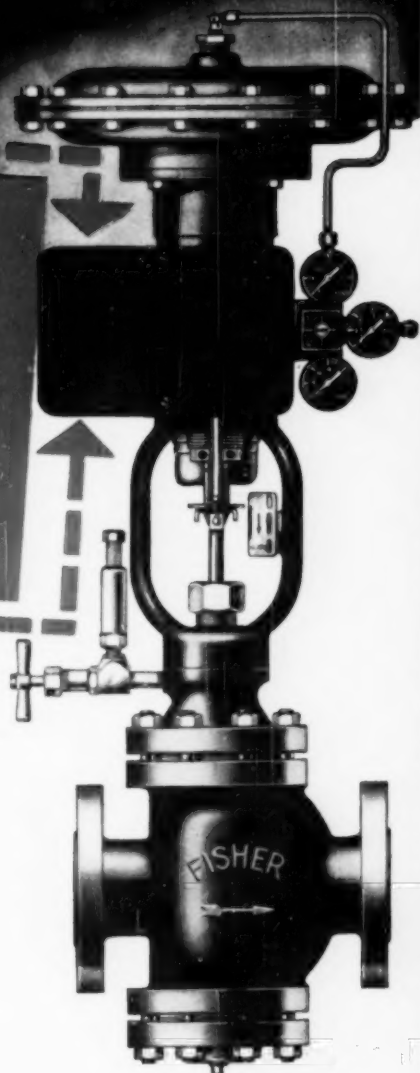


Cunard-
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Photo

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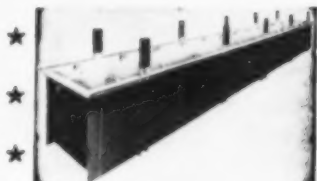
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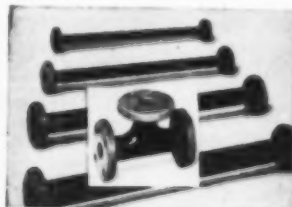
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FOREIGN LITERATURE ABSTRACTS

Aluminum Industry in Germany

There have been few changes in the method of aluminum manufacture by fusion electrolysis in recent years. It takes 4.4 tons of bauxite to produce one ton of aluminum. The bauxite has to be imported and it represents 8 percent of the selling price of the finished aluminum. A ton of aluminum also requires 50 kg. of fluxing material and 500-600 kg. of electrode carbon in its manufacture. Experiments have been conducted in large industrial plants to find an economical method for preparing aluminum from German clay but none of them have yet been sufficiently successful to replace bauxite as a raw material. German production of aluminum in 1942 was 264,000 tons; the 1949 production should be from 20,000 to 24,000 tons. The Töging works at Inn was able to resume operations in March 1948. The Lünen works was held up by lack of the necessary amount of carbon but it was producing 1,000 tons of aluminum per month early in February. The Grevenbroich works has not yet

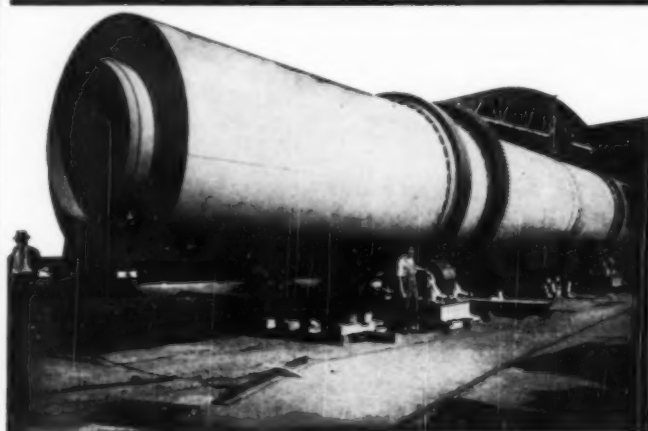
been put into operation due to insufficient current generation in the Rhenish lignite country. The German aluminum industry cannot compete in the world market for some time although there is a sufficient quantity available for exportation.

Digest from "Germany's Light Metal Industry" by E. A. Struss, *Chémie-Ingenieur-Technik* 21, No. 2-4, 75-76, 1949. (Published in Germany.)

New Piperidone Synthesis

Development of new and more practical methods for the production of γ -piperidones was undertaken for two reasons: (1) synthesis of new anesthetics of the encaïne type, (2) broad possibilities for synthesis of different new derivatives in the piperidine series to which a large group of alkaloids, chemico-pharmaceutical preparations and medicinals belong. The simplest γ -piperidones, which are formed by the action of ammonia and methyl amine on divinyl ketones, are usually very unstable and have a tendency toward autocatalytic condensation. This is no doubt due to

(Continued)



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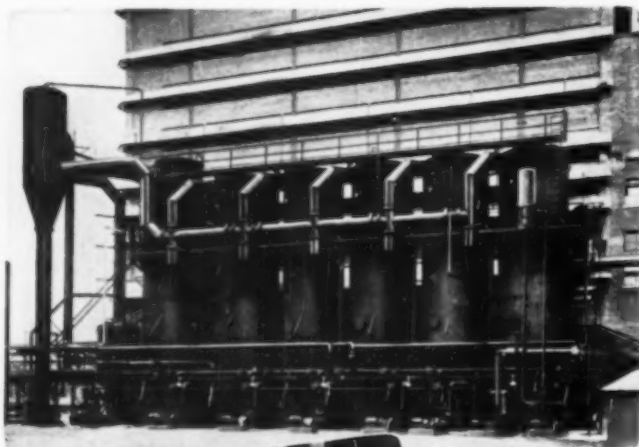
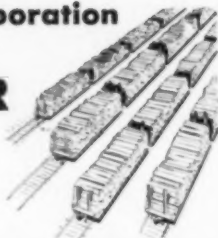
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FOREIGN ABSTRACTS, CONT. . .

the absence or insufficient quantity of substitutes in the piperidone nucleus which would retard this condensation. Consideration was therefore given to the reaction of ammonia and methyl amine with vinyl allyl ketones which are readily available and so diverse in character they would provide wide possibilities for synthesis of γ -piperidones of the most varied structure. The reaction of ammonia and methyl amine with substitutes of vinyl allyl ketones (but not vinyl allyl ketone itself) proceeded readily and in many cases gave yields of piperidones of up to 80 percent. γ -piperidones are produced even more readily by the reaction of ammonia and methyl amine with methoxy ketones obtained by hydration of divinyl acetylene hydrocarbons in aqueous solutions of methanol.

Digest from "Acetylene Derivatives. Report No. 84. Synthesis and Investigation of Heterocyclic Compounds. V. Action of Ammonia and Methyl Amine on Vinyl Allyl Ketones. New Method of Synthesis of γ -Piperidones" by I. N. Nazarov and V. A. Rudzko, *Izvestia Akademi Nauk SSSR, Khimicheskii Seriya*, No. 6, 511-520, 1948. (Published in Russia.)

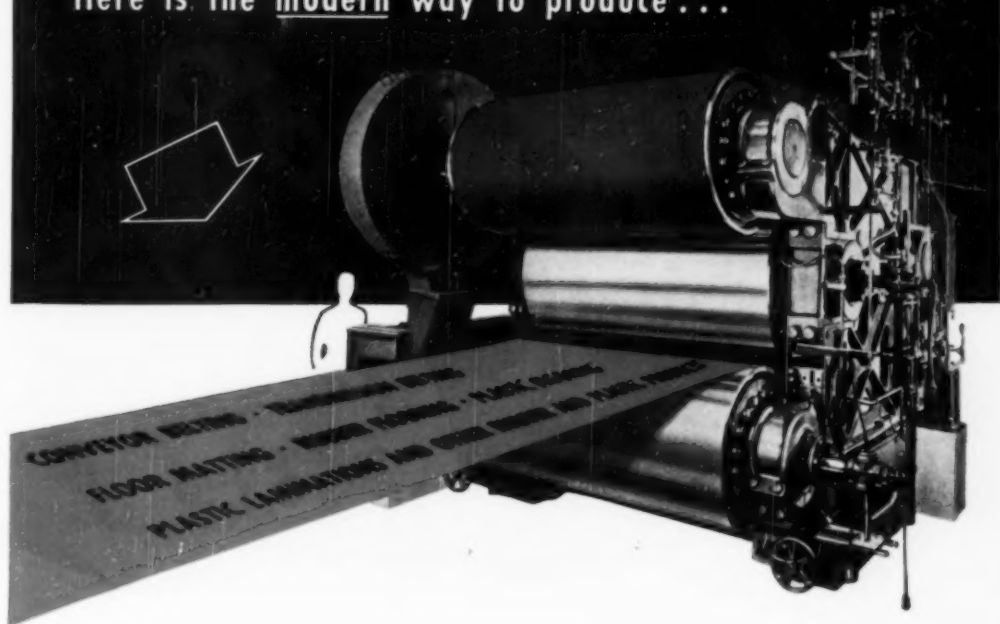
Water Treatment in the Paper Industry

Mud which accumulates in the system through which paper pulp circulates must be controlled to prevent such troubles as: silting of the pipes, poor formation of the sheet, holes in the paper, dirt in the calendars, destruction of the felts, time wasted cleaning storage tanks. The problem of mud control is specific for each mill and the choice of chemical agent to inhibit formation of this mud is determined by the following considerations: (1) Concentration at which its inhibiting action is effective; (2) degree of selectivity; (3) after effects; (4) ease of handling, solubility, color, and odor; (5) toxicity; (6) adsorbability by the paper. Chlorine is still the primary agent used for this purpose; it is added to water principally to destroy the microorganisms. The bactericidal efficiency of chlorine and its compounds depends on the period of reaction, temperature, pH, and concentration of chlorine. Chlorine and ammonia are introduced into industrial waters together to form chloramines. New substances are now being investigated for prevention of mud formation, such as: organic mercury compounds, chlorophenols, detergents, and compounds of secret composition.

Digest from "Treatment of Waters in the Paper Industry" by Jorge Roldan, *Quimica VI*, No. 3, p. 45-51, 1948. (Published in Mexico.)

—End

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LESTER B. POPE, Assistant Editor

Frontiers in Chemistry

HIGH MOLECULAR WEIGHT ORGANIC COMPOUNDS. (330 pages, \$5.50.) RECENT ADVANCES IN ANALYTICAL CHEMISTRY. (209 pages, \$4.50.) Edited by R. E. Burke and Oliver Grummitt. Interscience Publishers, New York.

Reviewed by Frederick C. Nachod

Two new volumes which cover the Western Reserve lectures have just appeared to take their place in this already well established series.

Vol. VI deals with various aspects of high polymer chemistry. The table of contents indicates the scope:

Polymerization in Suspension and Emulsion, by Walter P. Hohenstein and H. Mark; Osmometry and Viscosity of Polymer Solutions, by W. J. Badgley and H. Mark; Nature of Elastomers, by Harry L. Fisher; Aspects of the Structure and Reactions of Proteins, by John T. Eddall; Condensation Polymerization and Constitution of Condensation Polymers, by Paul J. Flory; Physical and Chemical Structure of Phenoplasts, by T. S. Carswell.

Emphasis is placed on theory of polymerization and on structure of polymers. A somewhat different note is struck by Dr. Eddall in his treatment of structure and reaction of proteins. The subject matter in all chapters is covered by experts and handled authoritatively.

Vol. VII is perhaps not as uniform and comprehensive as the preceding one. It covers the following topics:

Voltammetry (Polarography) and Amperometric Titrations, by I. M. Kolthoff; Inorganic Analysis with Organic Reagents, by John H. Yoe; Some Recent Colorimetric and Gravimetric Organic Reagents, by John H. Yoe; Application of Infrared Spectroscopy in Analysis, by Otto Beeck; Electron Microscopy and Microanalysis—New Methods in Chemistry, by James Hillier; Fractionation, Analysis, and Purification of Hydrocarbons, by Frederick D. Rossini; Applications of the Mass Spectrometer, by J. A. Hipple.

While fields such as infrared spectroscopy and mass spectrometry have been covered quite recently, ("Infrared Spectroscopy" by Barnes, et al. as well as chapters by West on the same subject and by Stewart on mass spectrometry, both in Weissberger's "Physical

Methods of Organic Chemistry"), the remainder of the booklet contains much new and useful information. These reviews are likewise instructive and expertly handled.

Editors Burke and Grummitt are indeed rendering a service to chemical literature in making available the Western Reserve lectures to a larger audience.

The printing, binding, and make-up are excellent. The two new volumes of Frontiers in Chemistry will make friends readily and can be recommended to teacher and experimenter alike.

Prolin

TREATISE ON POWDER METALLURGY, Vol. I: Technology of Metal Powders and Their Products. By Claus G. Goetzl. Interscience Publishers, New York. 778 pages. \$15.

Reviewed by C. L. Mantell

This is the introductory volume of a series of three. It deals with the powder metallurgy process, its terminology, advantages and disadvantages, history, methods of powder production, characteristics of the powders, the testing procedures, the commercial forms, grades, processing and applications in molding by cold and hot pressing, the behavior of the powders under compression, the principles and practices of sintering, heat treating

and finishing treatments of the parts.

Dr. Goetzl was associated with Charles Hardy, one of the early commercial protagonists for powder metallurgy, and Paul Schwarzkopf, also an author of a book on the subject. He has been very active during a period of rapid development and advance in the field of his book.

The author has successfully accomplished "an attempt to organize the mass of present day knowledge in a methodical manner." In view of the voluminous literature, this is a formidable task.

The chemical, physical and mechanical phases of the discussion are well covered, while the engineering aspects of dies, presses, furnaces, and equipment are adequately treated. In view of the excellence of the book, the author's tendency to prolixity may be forgiven as the volume represents a recommended and valuable addition to the art and science of powder metallurgy.

Review

RADIOACTIVE MEASUREMENTS WITH NUCLEAR EMULSIONS. By Herman Yagoda. John Wiley & Sons, New York. 356 pages. \$5.

Reviewed by Jerome D. Luntz

In 1896 Henri Becquerel attempted to determine whether a fluorescent material had any effect on a photographic emulsion. By chance he selected uranyl sulphate for his experiment. It is now history that the exposed plates were darkened and that further investigation resulted in the revelation that it was the uranium content of the compound which caused the observed effect. This was the discovery of natural radioactivity.

In 1948, photographic plates were used in another historic experiment, the first creation of artificial mesons, the infinitesimal nuclear particles previously found only in cosmic rays. Thus, in a period of 52 years, the detection of nuclear radiations by photographic emulsions has assumed considerable importance.

Dr. Yagoda reviews the field in rather thorough fashion, covering both the theoretical and practical aspects of the subject. It is pointed out that "any scientist who owns a microscope

(Continued)

RECENT BOOKS RECEIVED

Citrus Products. By J. B. S. Braverman. Interscience. \$9.

Encyclopedia of Chemical Technology. Vol. 3. Ed. by R. E. Kirk & D. F. Othmer. Interscience. \$20.

Fuels and Lubricating Oils for Internal Combustion Engines. By R. Pugh & J. M. A. Court. Pitman. \$3.50.

Handbook of Patents. By H. A. Toulmin, Jr. Van Nostrand. \$9.

High Molecular Weight Organic Compounds. Ed. by R. E. Burke & O. Grummitt. Interscience. \$5.50.

Indentation Hardness Testing. By V. E. Lasaght. Reinhold. \$5.50.

Introduction to Statistical Mechanics. By R. W. Gurney. McGraw-Hill. \$5.

Plant Production Control. 2nd ed. By C. A. Koepke. Wiley. \$5.50.

Plastics in Engineering. 3rd ed. By J. Delmonte. Penton. \$10.

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BOOKSHELF, cont. . .

can make quantitative radioactive measurements." Applications in the fields of chemistry, physics, metallurgy, biology and petrography are described in detail. The chapter devoted to radiochemistry contains discussions of emulsions as applied to carriers used with short-lived radioisotopes, disintegration of radioactive series, and radiocolloid aggregation.

A very valuable feature of the book is the extensive bibliography of 700 items.

Water Testing

BIBLIOGRAPHY ON WATER AND SEWAGE ANALYSIS. SPECIAL REPORT No. 28. By B. H. Weil, P. F. Murray, George W. Reid, and Robert S. Ingols. State Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Ga. 220 pages. \$4.

Complete as the editors could make it up to January 1948, this bibliography was developed in conjunction with a project to make available rapid analytical techniques in water and sewage analysis. The collection includes 2,560 references, a significant number of which are to recent articles.

References have been sorted according to subject under the tests which are listed in the table of contents. Under each classification they appear in alphabetical order by authors' surnames. Since the listings are divided under numerous classifications, an author index has been prepared.—FA

Naphthalene

ELSEVIER'S ENCYCLOPEDIA OF ORGANIC CHEMISTRY. Edited by F. Radt. Series III. Carboisocyclic Condensed Compounds. Volume 12B. Naphthalene A. Compounds Containing One Naphthalene Nucleus. Hydrocarbons and Halogen Compounds. Elsevier Publishing Co., New York-Amsterdam. 344 pages. \$32.

Reviewed by C. G. Overberger

As indicated in the title, Vol. 12B is a part of Series III concerned with carboisocyclic condensed compounds.

The first 238 pages are concerned with naphthalene and its hydroderivatives with aliphatic, aromatic and isocyclic substitution. The remaining pages of this volume cover the halogenated derivatives of naphthalene and its hydroderivatives with the above mentioned substitution. This classification based upon structure, follows the pattern of previous volumes, that is, closely related compounds are placed together and then derivatives of (Continued)

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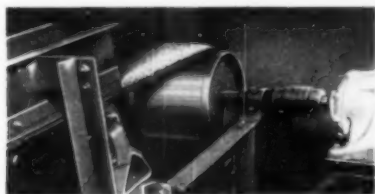
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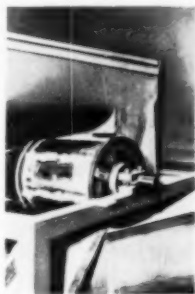


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BOOKSHELF, cont. . .

the parent compounds are described. The outstanding features of the classification system have been excellently reviewed by L. F. Fieser in the *Journal of the American Chemical Society* of March 1948.

The tremendous value of careful, exhaustive compilation of this type cannot be over emphasized. It is especially useful as references are covered up to Dec. 31, 1944, and later references dealing with structure are also included. There is a noticeable lack of errors in a volume of such detail. A complete formula and subject index enhance the usefulness of the volume. One very interesting feature is the incorporation of experimental work done by a member of the editorial staff to correct discrepancies in the literature. This is indeed a service above the line of ordinary duty.

This book is highly recommended for the reference library of organic chemists who can afford these volumes.

Review Summary

THE CHEMISTRY AND TECHNOLOGY OF ENZYMES. By Henry Tauber. John Wiley & Sons, New York. 550 pages. \$7.50.

Reviewed by Raymond Louis Feder

This book is an expansion of Tauber's previous book "Enzyme Technology" and discusses many of the important contributions to the field published up to 1947. In Tauber's own words the present volume "discusses almost all the known enzymes" and is a rather complete review summary of the enzyme field. The summary however is, of necessity, general and not too specific since most likely no one volume could possibly thoroughly encompass the entire field.

The book is divided into two parts. One consists of 15 chapters and deals with the chemistry of the general fields of enzymes. The effect of variables, the general application, the kinetics and the methods of analysis are discussed for the more important enzymes. Part II is divided among 17 chapters and is concerned with the technology of enzymes. The preparation of enzymes by mold and bacterial fermentations, the application of enzymes in the food, textile, paper, etc. fields and the microbiological assay of vitamins and amino acids are discussed in this section.

This book is valuable in that it presents an over-all and comprehensive review of the field of enzymes. It helps one in formulating an understanding in a general way of the role of enzymes in chemistry and in industry. (Continued)

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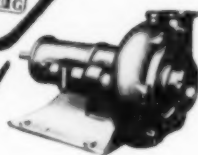
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try. It will certainly prove its worth as an important reference volume to those who are actively interested in enzymes.

Extensive

PAINT AND VARNISH TECHNOLOGY. Edited by William von Fischer. Reinhold Publishing Corp., New York. 509 pages. \$8.

Reviewed by Myron A. Coler

This volume is an outgrowth of the lecture series and courses in paint and varnish technology offered during recent years at the Case Institute of Technology. The over-all treatment is in accord with the growing appreciation that, despite complexities of phenomena which often demand an empiric approach and great individual skill in the solution of practical problems, the technology of organic finishes is nevertheless a proper chemical engineering subject and neither a vague art nor a collection of recipes.

The enormous intended scope of the book can best be indicated by noting major chapter titles and subtitles: Introduction to the Protective Coatings Industry; Drying Oils: Their Origin, Manufacture and Properties; The Chemistry of Improved Drying Oils; Pigments-General Classification and Description; White Hiding Pigments; Organic Toners and Mineral Pigments; Rosin and Rosin Derivatives; Natural Resins and Kindred Products; Alkyd Resin Technology; The Chemistry of Urea and Melamine Coating Resins; Phenolic Resins in Protective Coatings; Miscellaneous Resins in Protective Coatings; Solvent-Type Resins; Hydrocarbon Thinners; Formulation of the "Volatiles" in Nitro-Cellulose Lacquers; The Application of Metallic Soaps as Driers, Fungicides, Suspending Agents and Flattening Agents; the Testing of Raw Materials; Principles of Paint Formulation; Resin and Varnish Manufacture; Industrial Finishes; Trade Sales Paints; Water and Emulsion Paints; Solvent-Type Finishes; The Examination of Paints; Surface Preparation; Methods of Applying Surface Coatings; Resin and Varnish Making Equipment; Paint Manufacturing.

The attempted coverage of the many raw materials, finished products, fabrication and application techniques of the industry in a comparatively brief volume naturally favors an extensive rather than in intensive presentation. However, a high degree of expertness on many separate topics has been secured by drawing on the services of some thirty contributing authors.

In common with most compilations
(Continued)

To Obtain Better Yields

faster reactions, and lower cost of production, the chemical industry in recent years has developed new processes or improvements in old processes by greatly stepping-up temperatures and pressures. Because these more severe operating conditions involve more severe corrosive action, many of these processes would have been impossible without the use of Stainless Steel.

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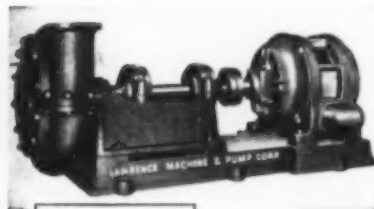
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BOOKSHELF, cont.

representing the work of a multitude of authors and organizations, there are inherent variations in command of subject matter, skill of presentation and perspective encountered in going from chapter to chapter as well as a certain amount of overlap. Thus, e.g., some chapters carry numerous references and/or illustrations whereas others are devoid of desirable documentation and illustrative material. Similarly, several chapters presuppose a reasonable acquaintance with high polymer chemistry whereas others are largely descriptive or involve sections depending on pseudo-technical trade names. As might be expected in an active field, many of the opinions expressed by individual authors are not universally held.

There are a few slips and points where the titling and organizational pattern are arbitrary or obscure; e.g., thermosetting allyls (p. 223) and silicons (p. 226) are listed under "Solvent-Type Resins" while the cumarone-indenes (p. 189) and the chlorinated diphenyls and homologues (p. 195) are included under the catch-all title: "Miscellaneous Resins in Protective Coatings." Chapter 4, entitled "Pigments—General Classification and Description" deals primarily with the extender pigmentary materials rather than pigments in general. Approximately 13 pages are allotted to electrostatic coating processes whereas less than 25 pages are allotted to all of the color pigments and blacks under the title "Organic Toners and Mineral Pigments."

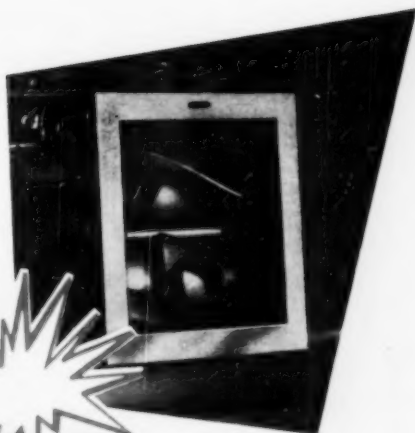
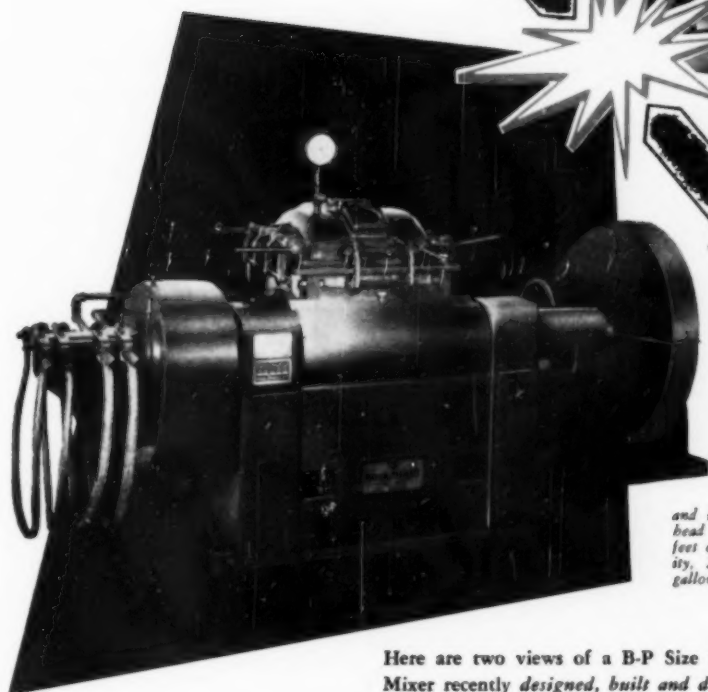
Viewed as a whole, Professor von Fischer has provided a worthwhile book which should prove of particular value as a text and reference source to students of surface technology on the introductory and intermediate levels. It should also prove of value to the larger group of readers comprising manufacturers, users and others who have felt the need for a single volume compromise between the many specialized and scattered miscellaneous books and articles and the encyclopedic multi-volume Mattiello series.

Lighting

FLUORESCENT AND OTHER GASEOUS DISCHARGE LAMPS. By W. E. Forsythe and E. Q. Adams. Rinehart & Co., New York. \$5.

A physicist and a physical chemist have joined their talents to turn out this book on fluorescent lamps. These two General Electric scientists have covered their subject thoroughly. They discuss history briefly. There follows an exhaustive study of the physics and (Continued)

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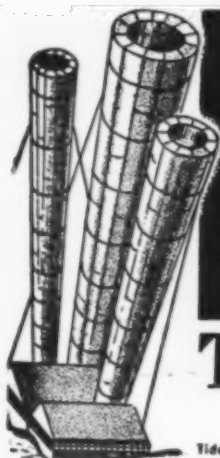
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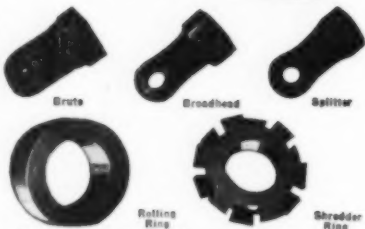
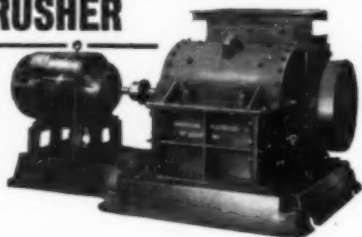
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BOOKSHELF, CONT. . .

physical chemistry of the subject. Television, arcs and short-duration light sources are also included. A most valuable chapter on operation of the fluorescent lamp will interest the casual reader. He'll find in it how his lamp works and what is wrong if it doesn't.—LBP

Viewpoint Broadener

PHYSICAL ASPECTS OF COLOUR. By Pieter J. Bouma. Elsevier Publishing Co., New York. 312 pages. \$5.50.

Reviewed by D. W. Vollmer

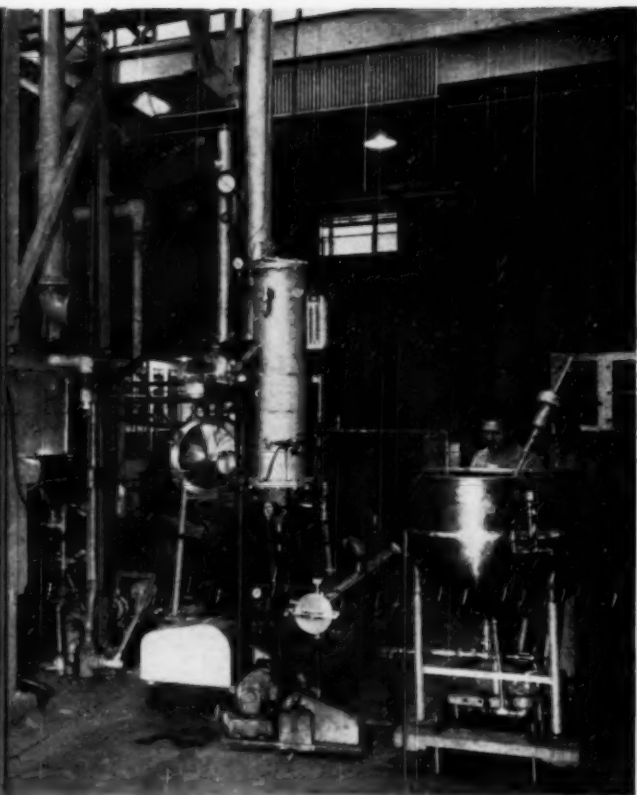
Because of modern electronic instrumentation all work in the field of color is open to rapid development in the direction of mathematical specification and control. Instrumentation and the science of color specification are definitely ahead of practical application. The progressive worker in color problems will be obliged to understand this mathematical specification of color and may be expected to extend its use. Therefore the publication of the English translation of P. J. Bouma's "Physical Aspects of Colour" is particularly appropriate. The text will be found to be no substitute for A. C. Hardy's "Handbook of Colorimetry." It will be welcomed however by the serious worker seeking background information in his field.

Dr. Bouma develops the concept of the tristimulus specification of color step by step, from the simple color triangle to color space and then back to two dimensional plotting on the Hardy color chart, with excellent diagrams and lucid discussion. By his use of diagrams and specific examples of all calculations he is definitely kind to the reader who might be discouraged by a stricter adherence to the completely symbolic language of mathematics.

The modern theory of color perception in its relation to objective spectrophotometry is discussed in a stimulating manner. The significance of the terms used in the monochromatic specification of color are reviewed. There is a chapter on defective color vision. The viewpoint of the average reader will be very much broadened by a very interesting chapter on the historical development of color science covering the concepts of Newton, Goethe, Young, Grassmann, Maxwell, Helmholtz, Koenig, Ostwald, and Munsell.

The bibliography includes the important papers of 250 authors. The fact that all but eight of these papers are specifically referred to is an indication of the breadth of viewpoint covered in the text. —End

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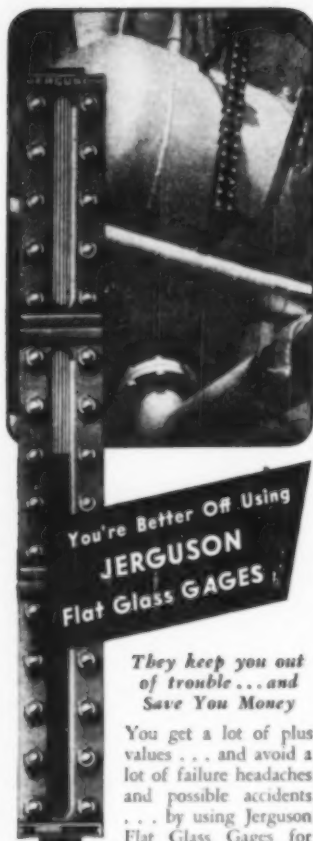
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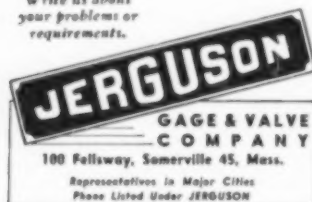
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GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publications noted in this list always give complete title and the issuing office. Remittance should be made by postal money order, coupon, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the bureau responsible for its issue.

Historical Statistics of the United States, 1789-1943. Bureau of the Census. Price \$2.50.

Improved Preparation of Acrylic Rubber: Curing Methods and Properties of the Vulcanizates. By W. C. Mast and C. H. Fisher. U. S. Department of Agriculture, Eastern Regional Research Laboratory, Philadelphia 18, Pennsylvania. AIC-208. Mimeographed.

List of Available Publications of the U. S. Department of Agriculture. Compiled by Eleanor W. Clay. Miscellaneous Publication No. 60, revised November 1946. Gives complete list of all series of documents which were available November 1946.

Fiber and Spinning Properties of Cotton—A Correlation Study of the Effect of Variety and Environment. By Henry D. Barlow and Otis A. Pope. Department of Agriculture, Technical Bulletin No. 970. Price 15 cents. An analysis of the fiber characteristics as they relate to spinning and textile performance.

The New Insecticides for Controlling External Parasites of Livestock. Department of Agriculture, E-762 (revised). Emphasizes essential safety restrictions as well as indicates proper field methods to secure maximum effectiveness.

Portable Water-Jet Pumps. By M. L. Fein. Bureau of Agricultural and Industrial Chemistry. AIC-223. Available from East-

ern Regional Research Laboratory, Philadelphia 18, Pa. Mimeographed. Small scale engineering laboratory equipment.

Animal Fibers Used in Brushes. By T. M. Platt Hardy and John I. Hardy. Bureau of Animal Industry. Circular C 802. Price 10 cents. Types of commercial soft-brush and paint-brush fibers as well as their characteristics are given. Information is included on the conservation of paint brushes.

Yield and Composition of Cottonseed as Influenced by Fertilization and Other Environmental Factors. By W. H. Tharp, et al. Bureau of Plant Industry, Soils, and Agricultural Engineering, Technical Bulletin T 974. Price 30 cents. Discusses in terms familiar to the cottonseed industry and research workers the results of studies on fertilizers and other influences on cottonseed.

Nicotine Insecticides: Part V—Search for synergists. By E. L. Mayer and E. R. McGowan. Bureau of Entomology, and F. B. Talley, et al. Eastern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry. Bureau of Entomology and Plant Quarantine, E-763. Mimeographed.

1948 Yearbook of Forest Products Statistics. Food and Agriculture Organization of the United Nations. (Continued)

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GOVT. PUBLS., cont. . .

United Nations, 1201 Connecticut Ave., Washington, D. C. Price \$2.50. Contains information for 1946 and 1947. Bilingual (English and French), with a supplement in Spanish.

United Methods for the Analysis of Fatty Materials of the International Union of Chemistry. Translated from the French by Carroll L. Hoffpauir. Bureau of Agricultural and Industrial Chemistry. AIC-225. Available from Southern Regional Research Laboratory, New Orleans, La. Mimeographed. Third Report of the International Commission for the Study of Fatty Materials.

Prospective Plantings for 1946. Crop Reporting Board, Bureau of Agricultural Economics. Mimeographed. A late winter estimate of probable acreage to be planted to the principal crop in 1946.

Douglas Fir Plywood. National Bureau of Standards. Commercial Standards C845-46 (Supersedes C845-47). Price 10 cents.

Medical X-Ray Protection Up to Two Million Volts. National Bureau of Standards Handbook 41. Price 15 cents. One of the safety handbook series of the Bureau of Standards.

Optical Glass at the National Bureau of Standards. By Francis W. Glaze and Clarence H. Hahner. National Bureau of Standards Circular 466. Price 15 cents. A description of the manufacturing facilities at the bureau and a summary of the typical formulation and production methods utilized in preparing optical glass during the war period for military applications.

Improvements in Hydrogenation of Coal. By L. E. Hirst, L. C. Skinner, and E. E. Donath. Bureau of Mines. Information Circular I. C. 7488. Mimeographed.

Thermochemical Study of the Stability Relations of Gekielite ($MgTiO_3$) and Ilmenite ($FeTiO_3$) in Rocks. By Th. G. Sahama and D. R. Torselson. Bureau of Mines. Report of Investigations R. I. 4407. Mimeographed. Contains some heat-of-solution measurements and thermodynamic computations on Gekielite stability in rocks.

Thermochemical Study of the Olivines and Orthopyroxenes. By Th. G. Sahama and D. R. Torselson. Bureau of Mines. Report of Investigations R. I. 4408. Mimeographed.

Tests of the Ignition of Natural Gas-Air Mixtures by Permissible Explosives in the Experimental Coal Mine. By H. P. Greenwood, et al. Bureau of Mines. Technical Paper 716. Price 15 cents. Summarizes results of the various tests and cites safety precautions to be followed in using 3-lb. charges in coal mines.

Pilot-Plant Concentration of Arkansas Aluminum Ores. By S. M. Runkle, et al. Bureau of Mines. Report of Investigations R. I. 4440. Mimeographed.

The Japanese Aluminum Industry. By G. L. Allen and Virgil Miller. Bureau of Mines. Information Circular I. C. 7496. Mimeographed.

Investigation of Sulfur Graphite Deposits, Rockland County, N. Y. By W. T. Millar and R. S. Sanford. Bureau of Mines. Report of Investigations R. I. 4438. Mimeographed.

Investigation of Whiteware Clay Deposit, Fergus County, Mont. By R. N. Roby and A. P. Robertson. Bureau of Mines. Report of Investigations R. I. 4416. Mimeographed.

Trends in Man-Hours Expended Per Unit in Soap and Glycerin Manufacture, 1939 to 1947. Unnumbered document. Bureau of Labor Statistics. Mimeographed.

Prospecting for Uranium. Joint publication of U. S. Geological Survey and U. S. Atomic Energy Commission. Price 35 cents. Primarily a guide book for field geologists but of considerable reference usefulness for anyone interested in atomic energy.

Atomic Energy—Significant References. A periodic bibliography prepared by the legislative reference service of the Library of Congress. Available by purchase at 15 cents per copy or by subscription at \$1.50 per year. Subscriptions should be sent to Library of Congress with remittance by money order or check payable to Librarian of Congress.

—End



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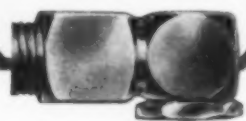
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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterheads.

Cooling Tower Operation. The Marley Co., Inc., Kansas City 15, Mo.—3-page pamphlet answers ten questions concerning cooling tower operation.

Electronic Equipment. Potter Instrument Co., Inc., 139-56 Roussett Ave., Flushing, N. Y.—4-page catalog is a brief guide to company's complete line of high speed electronic counters, sealers, counter chronographs and special electronic frequency measuring and computing equipment.

Flow Meters. Penn Industrial Instrument Corp., 3116 North 17th St., Philadelphia 32, Pa.—8-page Bulletin No. 800 shows by illustration steps in production of this company's electric and mechanical flow meters.

Control and Resistor Equipment. Clarostat Mfg. Co., Inc., Dover, N. H.—New catalog presents the line of resistors, controls, and resistance devices put out by this company.

Grinding Mill. J. B. Sedberry, Inc., Franklin, Tenn.—2-page brochure describes the grinding mill manufactured by this company for capacities of 300-1,200 lb. per hr. Screen range is from 1/64 to 1 1/2 in.

Electric Heating and Control. Electro-Therm Inc., Silver Spring 1, Md.—20-page illustrated booklet (Bulletin 103) describes this company's complete line of electric heating units and controls. Booklet includes complete data on equipment as well as convenient temperature conversion tables, an application guide and information on special-purpose heating units.

Steel. Jessop Steel Co., Washington, Pa.—15-page booklet gives properties and applications of the stainless and heat resisting steels produced by this company.

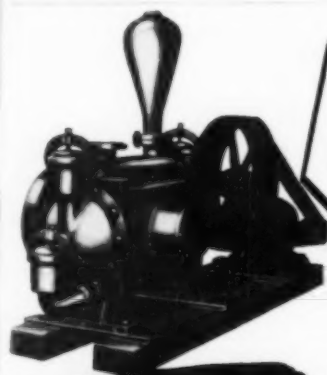
Paper Stock Pump. Allis-Chalmers, Milwaukee 1, Wis.—4-page pamphlet describes this company's new paper stock pump. Engineering drawings, cut-away pictures and specifications are included in the booklet.

Monosodium Glutamate. A. E. Staley Mfg. Co., Decatur, Ill.—Brochure makes suggestions on the use of glutamate in preparation of processed foods.

Insulated Piping Systems. The Ric-vel Co., Cleveland, Ohio.—Two new booklets put out by this company deal with problems involved in insulated underground piping distribution systems. "Engineering Data for Underground Steam Distribution, Section 460-2" is a 30-page booklet on layout of routes, methods of estimating steam loads, steam flow charts and tables, properties of steel pipe, and related subjects. "Typical Engineering Drawings—Section 460-3," a 40-page booklet, reproduces drawings of a wide variety of insulated piping systems, including industrial, educational, housing, hospital, public utilities, railroad, and governmental projects.

Centrifugal Pumps. Rice Pump & Machine Company, Milwaukee 4, Wis.—This pamphlet describes the two self priming centrifugal pumps put out by this company. The pumps have 7,000 and 10,000 ghp. capacities respectively.

Spray Drying Equipment. Swenson Evaporator Co., Harvey, Ill.—16-page Bulletin (Continued)



**SHRIVER
DIAPHRAGM PUMP**

for Corrosive, Abrasive, Thick
Heavy or Viscous Fluids

FOR THOSE
HARD-TO-PUMP
MATERIALS

Use the Pump
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You can avoid the high repair and replacement costs caused by wear on pumps where the fluid destroys the operating mechanism. In the Shriver Diaphragm Pump the fluid is separated from the mechanical parts of the pump by rugged diaphragms that avoid contamination and destructive wear. Only the liquid ends need be built of any metal or rubber-coated for protection. Pumping action is positive; operation—simple; cleaning—easy; maintenance cost—negligible.

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HYDRAULICALLY OPERATED

TRACTO LOADERS

for all kinds of material handling

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- * Standard bucket: 10 Cu. Feet
- * Weight 5,250 lbs.
- * Major tractor components — Allis-Chalmers
- * Brake Hp. 27.5
- * Max. clearance under bucket hinge, 6' 2"
- * NOTE—Interchangeable buckets and other accessories



MORE PRODUCTION WITH LESS OPERATOR EFFORT

FULL LOAD IN BUCKET MAKES STEERING EASIER

—NOT HARDER Tracto-Loader design — bucket over driving wheels, steering wheels in rear — gives you better traction, easier steering. Saves bogging down — saves dumping part of load to get out of soft going.

GETS BIG LOADS IN SMALL WORKING AREAS Eases into material — no ramming. Forward crowding action and automatic "tilt-back" of bucket mean fast, easy loading . . . bigger loads, in closest quarters!

HYDRAULIC BUCKET CONTROL Fast-acting, positively controlled bucket can be dumped in part or all at once at any height to maximum. Dumps clean — sticky material shakes loose.

FULL VISION Unobstructed operator vision . . . handy controls, comfortable seat.

HIGHEST QUALITY MATERIALS THROUGH-OUT for long, dependable service. Hydraulic system has leak-proof, seamless steel tubing and hose lines with "Instant Fix" detachable and re-usable fittings — no waiting for parts.

model TL-W

- * Standard bucket: $\frac{1}{2}$ Cubic Yard
- * Weight 8,000 lbs.
- * Major tractor components — Allis-Chalmers
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- * Max. clearance under bucket hinge, 8' 8"
- * NOTE—Interchangeable buckets and other accessories



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These media will withstand higher operating temperatures than any other. In addition they are completely resistant to hot concentrated acids (except hydrofluoric and hot phosphoric).

These media have widely diversified chemical resistance. For best results, they should not be continuously exposed to temperatures exceeding 170° F. or above can be exposed to intermittent exposure to 215° F. or above excellent resistance to acids and alkalis (except ammonium hydroxide) as well as alcohols and aliphatic hydrocarbons. They also show fair to good resistance to aromatic hydrocarbons, halogenated hydrocarbons, ketones, esters and ethers.

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If your filtration operation can be improved through the use of filter cloth having the properties of either Glass or Saran, send for a laboratory test sample of either or both.

The extremely wide range of synthetic filter media which we have developed over the years have effected some startling economies in many of our customers' operations. We are certain they can do the same for you.

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*T.M. C&CC



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2627 West 19th St.	Roseview Center Bldg.	1406 Second National Bank Bldg.	Norwalk, Conn.	Edward L. Bateman

MFR.'S PUBS., cont. . .

No. D-105 describes the principles and advantages of the spray drying process and spray drying equipment put out by this company. The booklet includes flow charts of several spray drying applications.

Heat Transfer Units. Young Radiator Co., Racine, Wis.—Two catalogs, No. 148, 20 pages and No. 248, 4 pages, describe heat transfer units manufactured by this company. The latter catalog contains engineering data on heaters and blowers.

Air Filters. Continental Air Filters, Inc., Louisville, Ky.—4-page Bulletin No. 201-A gives a technical description of the automatic, self-cleaning air filter put out by this company. Engineering and performance data are included in the pamphlet.

Galvanic Cell Corrosion. The International Nickel Co., Inc., New York 5, N. Y.—An 8-page report on the reasons for galvanic cell corrosion and methods of overcoming it.

Blast Furnace Gas Burners. Prebody Engineering Corp., 580 Fifth Ave., New York 19, N. Y.—4-page bulletin describes this company's line of blast furnace gas burners. The bulletin includes cross-section drawings of burners for waste and primary fuels.

Materials Handling Equipment. Revolver Co., Tonawanda Ave. at 86th St., North Bergen, N. J.—This 4-page Bulletin No. 166 describes four of this company's low cost power lift truck and includes dimensions drawings.

Electric Hoists. The Harrington Co., 17th and Callowhill Sts., Philadelphia 30, Pa.—8-page pamphlet P-53 gives descriptions, illustrations and data on the company's line of electric hoists.

Dehumidifier. Industrial Corp., 88-33 76th Ave., Glendale, Brooklyn 20, N. Y.—4-page Bulletin DD-100 describes this company's dehumidifier. Pamphlet includes moisture factor chart and directions for determining proper dryer size.

Cellulose Gum. Hercules Powder Co., Wilmington 99, Del.—This 11-page technical booklet lists the properties and uses of cellulose gum and includes viscosity graphs and various descriptive tables.

Steel Mesh. Joseph T. Ryerson & Son, Inc., Chicago 80, Ill.—8-page bulletin gives uses and engineering data on load deflection, airflow comparison, and free openings of both standard and flattened mesh types of expanded steel, manufactured by this company. The leaflet also lists dimensions and weights of available sizes.

Belt Conveyors. The Rapids-Standard Co., Inc., Grand Rapids 2, Mich.—4-page leaflet describes the power belt conveyors put out by this company. Outstanding construction and operation features are given individual mention and illustration.

Grinding Media. Allis-Chalmers, Milwaukee 1, Wis.—4-page Bulletin 0737092 describes the characteristics of the company's forged steel and cast alloy iron convex-concave grinding media.

Pressure Gages. Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, Ohio—8-page bulletin describes the line of this company's pressure gages. These gages handle pressures up to 55 in. of water.

Conveyor and Elevator Belts. New York Belting & Packing Co., 1 Market St., Passaic, N. J.—74-page manual lists engineering characteristics and description of belts manufactured by this company.

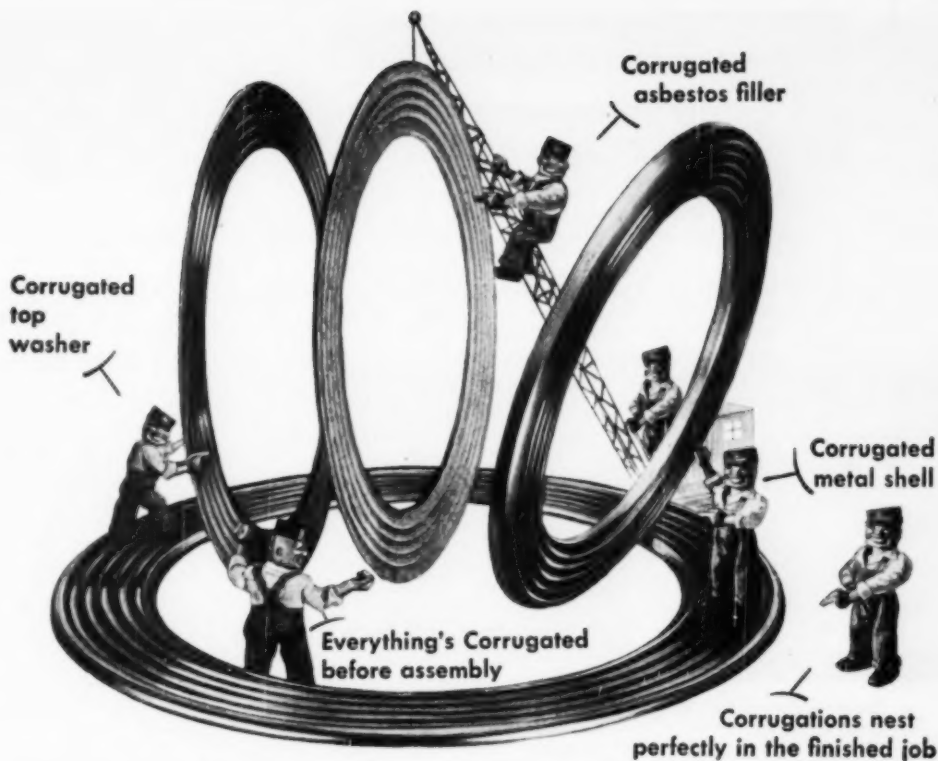
Centrifugal Sifter. Abbe Engineering Co., 50 Church St., New York 7, N. Y.—8-page illustrated leaflet describes this company's sifter, which operates by centrifugal rather than vibratory motion. Capacities are indicated.

Copper Plating. Macdermid Inc., Waterbury 44, Conn.—2-page technical data sheet lists typical applications of Rochemex, this company's liquid addition agent for copper plating.

Screening Feeders. Symtron Co., 610 Lexington St., Homer City, Pa.—2-page illustrated brochure describes this company's line of vibratory screening feeders.

Vertical Circulating Pumps. Byron Jackson Co., Pump Division, Terminal Annex, Box 2017, Los Angeles, Calif.—12-page illustrated bulletin describes the complete line of

(Continued)



Greater Strength... More Resilience... Perfect Sealing!

...with this corrugated metal-asbestos gasket

IN THE FABRICATION of the Goetze Style 926 metal-asbestos gasket shown here, each of the three units is corrugated *individually* to assure perfect "nesting" and matching in the assembled gasket.

This results in greater strength and resilience . . . and better scalability under high pressure. For these reasons, this gasket is recommended and widely used in chemical plants, power stations and oil refineries, especially where destructive elements are encountered.

Goetze custom-made gaskets—such as Style 926 above—pay off in the long run because of the meticulous care that is taken with every detail of construction . . . care and skill that is based on more than sixty years of meeting the specialized gasket requirements of industry.

If you're seeking a gasket that will not have to be replaced so often—in standard or non-standard sizes—we will gladly furnish estimates and recommendations on request. Write Johns-Manville, Box 290, New York 16, N. Y.



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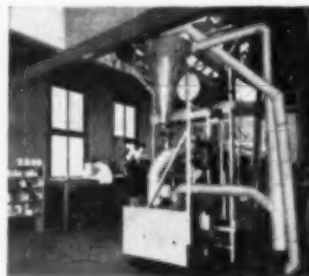
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Ferrous Sulphate—Anhydrous & Crystals	
Sterols	Naphthoic Acid
Zinc Sulfate	Mercury Powder
Mercuric Oxide	Silica Gel

And other compounds designated by letters or numbers only.

PLASTICS

Cellulose Acetate
And others known only by trade names

FOOD PRODUCTS

Sugar—Cane—Beet—Corn—Milk—Grape	Salt
Starch—Corn—Potato—Yucca	Glutamic Acid

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Tobacco	Hay
Poultry Manure	Concentrates
Tungsten Ores	Corn Cobs—Molasses

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Division Hersey Mfg. Co. • E & Second Streets • So. Boston, Mass.

MER.'S PUBS., cont. . .

single and multi-stage vertical circulating pumps put out by this company. Capacities vary from 20 gpm. to more than 3,000 gpm.

Benthal. Development Department Organic Chemicals Division, Monsanto Chemical Co., St. Louis, Mo.—This 7-page technical bulletin O-D-503 describes the use of Benthal, 85 percent benzoic acid, with phthalic or maleic anhydride and acids in the manufacture of short oil modified alkyd resins where low acid number and viscosity are desired.

Precision Dial Manometer. Wallace & Tiernan Products Inc., Belleville 9, N. J.—4-page brochure describes and gives specifications of the precision dial manometers made by this company.

Dehumidifiers. Pittsburg Lectodryer Corp., Box 1768, Pittsburg 30, Pa.—This bulletin entitled "Because Moisture Isn't Pink" shows the range of industrial uses of the dehumidification equipment produced by this company.

Corrosion Control for Underground Pipe. Owens-Corning Fiberglass Corp., Toledo 1, Ohio—28-page manual describes methods of applying Fiberglas pipe wrap to underground pipelines for corrosion control. Test data on the properties and performance of this pipe wrap are included.

Emulsifying Thickening and Suspending Agent. R. T. Vanderbilt Co., Specialty Department, 230 Park Ave., New York 17, N. Y.—This 43-page booklet is divided into two sections. The first describes the product, a colloidal magnesium aluminum silicate, put out by this company and lists its properties. The second section is a workbook of formulas for the application of this chemical in drugs, cosmetics, and products for industrial, agricultural or household use.

Heavy Electric Equipment. Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Mo.—The first issue of the Wagner Industrial Product News, a 4-page publication, describes the development of this company's electrical products.

Chlorine Bleach Solutions. Solvay Sales Division, Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.—48-page Bulletin No. 14 discusses the general properties of hypochlorous acid and its salts, the types of industrially important bleach liquors, and their preparation. Chlorination equipment and the production of chlorine bleaches are discussed in the bulletin which includes illustrations, tables, charts and graphs.

Conveyors. Inland Equipment Corp., 101 Park Ave., New York 17, N. Y.—A group of new bulletins describes the special and general purpose conveyors manufactured by this company. The three latest bulletins are Nos. F-26, 1P-1, and HP-20-1A.

Rotary Vacuum Pumps. Beach-Russ Co., 50 Church St., New York 7, N. Y.—6-page Bulletin No. 87 describes this company's rotary positive-single stage pumps for dry and semi-wet vacuum applications. Folder includes graphs, specification tables, and instructions for determining the pump size.

Insecticides. Hercules Powder Co., Wilmington 99, Del.—A 15-page pamphlet on "Facts About Toxaphene Insecticides" made by this company. This booklet lists applications for various harmful insects.

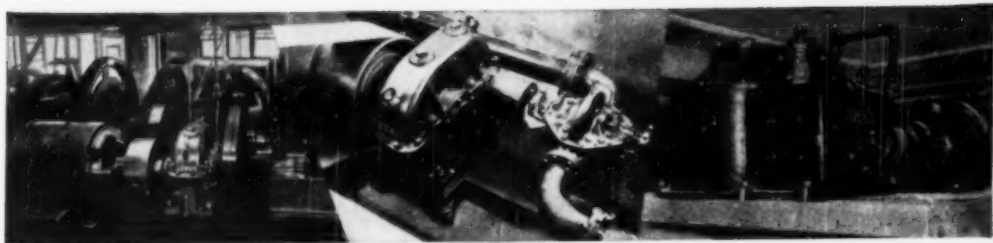
Plant Construction. Wigton-Abbott Corp., 1225 South Ave., Plainfield, N. J.—This is a 12-page booklet entitled "Packaged Plant Construction" describing a broadened concept of plant construction to effect saving both in time and money through centralized responsibility.

Chemicals. Rohm & Haas Co., Washington Square, Philadelphia 5, Pa.—28-page Bulletin No. 4-SP-99 describes a group of six chemicals produced by this company by means of the OKO process when the raw material is disubutylene. Properties, specifications, and physical reactions of these chemicals are listed.

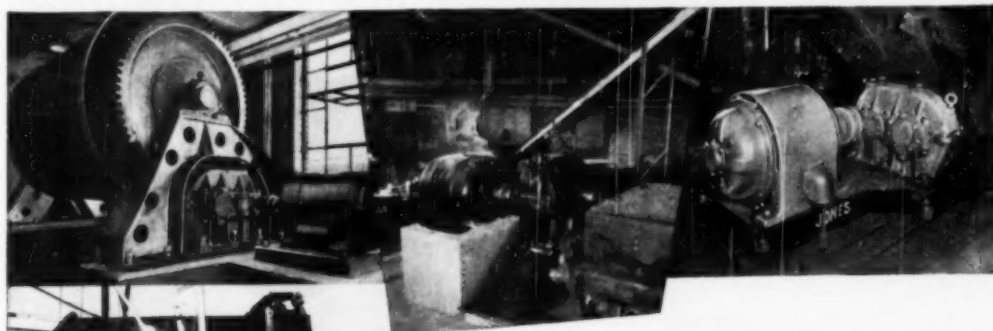
Bag Closing Machine. Union Special Machine Co., 409 N. Franklin St., Chicago 10, Ill.—16-page Bulletin No. 200 describes the line of bag closing machines produced by this company. Specifications and capacities for the various machines are listed, and various types of closures are indicated.

Rayon. Armstrong Cork Co., Lancaster, Pa.—Typical modern rayon plant is shown in a cutaway, 21 by 22 in. full color print.

—End



JONES DRIVES FOR INDUSTRY



★ For many years the W. A. Jones Foundry & Machine Company has been called upon as a consultant, to help solve a great variety of difficult drives involving the use of speed reducers, gears and other transmission machinery. In many cases these installations have called for the development of special equipment, designed and built to suit the specific requirements of the project.

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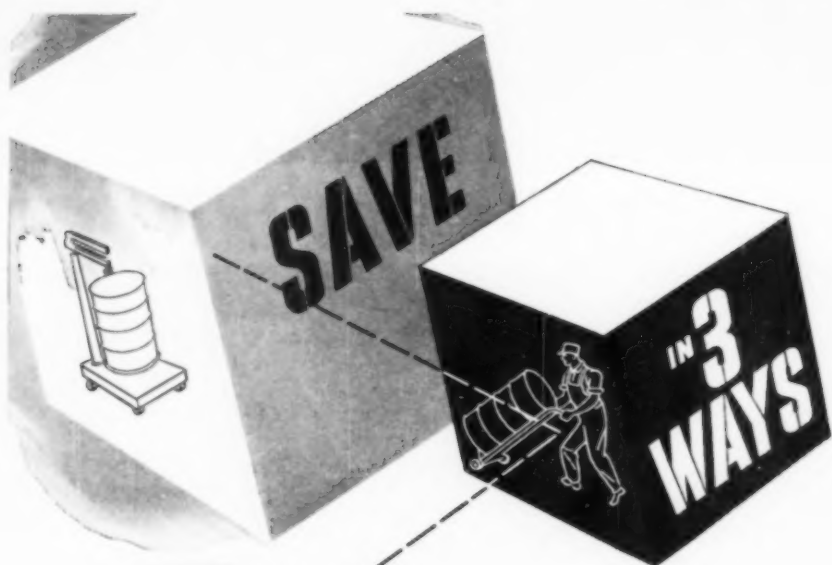
JUST ASK FOR BULLETIN NO. 80 ➡



• These illustrations show application of Jones drives to solve a wide range of industrial power transmission problems.

Jones

WORMS—WORMS—GEAR SPEED REDUCERS • CUT AND MOLDED TOOTH GEARS • PULLEYS
ANTI-FRICTION PILLOW BLOCKS • V-BELT SHEAVES • FRICTION CLUTCHES • TRANSMISSION APPLIANCES



**WITH
CITRIC
ACID
ANHYDROUS**

- 1. YOU SAVE ON INITIAL COST**
- 2. YOU SAVE ON SHIPPING EXPENSE**
- 3. YOU SAVE ON STORAGE and HANDLING CHARGES**

While the price of Citric Acid Anhydrous *looks* higher in the Price List — it's definitely to your advantage. As the Anhydrous form has over 8.5% *greater acidity* than the U.S.P., 201 lbs. of Anhydrous Citric Acid equals a 220 lb. drum of U.S.P.! Thus on a *cost basis alone* you save when you use the Anhydrous form instead of U.S.P.

But what's more, you save on shipping expense. When you buy the Anhydrous form you don't pay freight on useless water — all you get is what you use — uniform, pure Anhydrous Citric Acid, the preferred acidulant. Third — but of importance to quantity users — is the saving in storage and handling charges. By using Anhydrous you save storage, handling, and mixing charges on one drum in every eleven drums used.

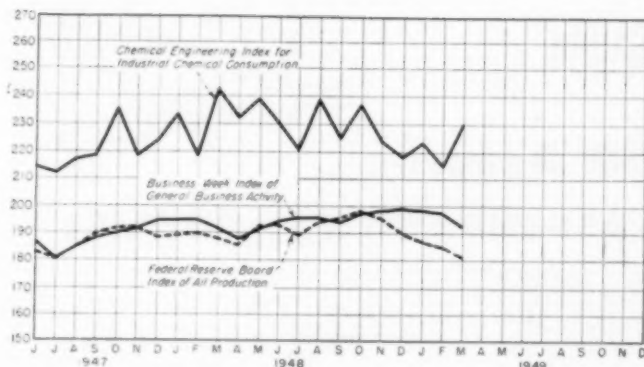
And it's no problem to switch from the U.S.P. to Anhydrous form. Just ask us for a conversion chart when sending in your order to Pfizer — the world's largest manufacturer of Citric Acid. Chas. Pfizer & Co., Inc., 630 Flushing Ave., Brooklyn 6, N. Y.; 211 E. North Water Street, Chicago 11, Ill.; 605 Third Street, San Francisco 7, Calif.

PFIZER *Manufacturing Chemists Since 1849*



Chemical Economics

RICHARD F. WARREN, Assistant Editor



Census of Manufactures Returns Show Huge Growth in Chemical Process Industries

Preliminary returns of the Census of Manufactures are revealing some rather startling growth patterns. However, to those who have been measuring growth trends since the 1939 Census, the figures are reassuring. They tend to bear out estimates made by most experts in the process industries. The producers of industrial inorganics, n.e.c., shipped products worth \$675 million in 1947. This is 223 percent above the 1939 level. Organics, n.e.c., showed a greater growth. Value of shipments in 1947 was \$1.45 billion, or 383 percent above 1939. Soap and glycerine shipments reached \$1.1 billion, a gain of 360 percent over 1939. Synthetic fibers producers sales reached \$705 million in the recent census year. Synthetic rubber contributed \$235 millions to the total value of chemicals shipped in 1947.

Sales of alkalis and chlorine more than doubled in the eight year period between the census years. Dollarwise, flat glass output rose 240 percent and glass container production was up about 275 percent in the same period. Inorganic pigments climbed more than 340 percent, while medicinal chemical production rose 960 percent in that interval.

New rubber consumption in April dropped to 84,700 long tons from the March level of 91,600 long tons. This

is about the same as the level reached in April 1948. However the four-months totals for the two years shows that new rubber consumption this year is down about 6 percent. Reclaimed rubber use is off 22 percent. Synthetic rubber consumption is holding up better than natural. In April consumption of this type was about 6 percent above the April 1948 rate. This increased use of synthetic rubber has created considerable worry on the part of Dutch rubber interests. They claim that the small rubber plantations can not compete with synthetic at current prices.

Rayon production skidded downward in the first quarter as deliveries for broad woven goods dropped 12 percent and knit goods dipped 17 percent. Tire cord and related uses held at high levels and bolstered the consuming market. The net crop in production was therefore only 7 percent below the last quarter of 1948. But rayon stocks have jumped from 21.4 million pounds in January to 63.0 million pounds in April. Total rayon deliveries in April were only 55.9 million pounds compared with an average monthly consumption of 91.7 million pounds in 1948. This slump in rayon together with weaker glass and textile markets has been giving the alkali producers some selling problems.

Index Itemized

Chemical Engineering Index
Industrial Consumption of Chemicals

	February	March
Fertilizers	51.33	61.81
Pulp and paper	22.91	23.26
Petroleum refining	22.95	21.71
Glass	17.15	17.89
Paint and varnish	19.50	23.35
Iron and steel	13.70	15.40
Rayon	22.00	20.95
Textiles	9.19	9.72
Coal products	10.12	11.15
Leather	4.56	4.61
Explosives	6.85	6.83
Rubber	4.77	5.22
Plastics	8.08	8.67
INDEX	215.03	230.07

1933 = 100

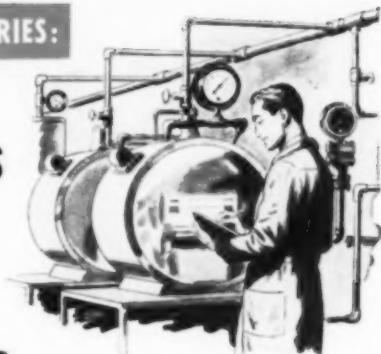
Steel, another sizable consumer of chemicals dropped below 100 percent of capacity in April, but the steel output in the first four months was 13 percent ahead of the corresponding 1948 period. Actual operating rates were down about 4.3 percent from the all-time record (102.7 percent of capacity) reached in March. However, average weekly production of steel-making furnaces was higher than the average weekly output of any month prior to this year with the exception of November 1948. Early in May the operating rate was down to 96.2 percent of capacity. While the decline seems to indicate a general drop to more reasonable levels of operation in this industry, this is still almost 140 percent above the highest prewar activity.

WEAK ALKALI MARKET

Alkali producers were out beating the brush again last month. They were looking for customers to replace the declines in textiles, glass and petroleum refining markets. To add to the worries of some producers, demand for chlorine is running ahead of caustic requirements. All this adds up to the fact that the caustic soda market is weak. Some producers will be faced with sizeable surpluses if the current trend is not reversed. This situation has stimulated the work on production of chlorine without the coproduction of caustic soda. Local surpluses of hydrochloric acid have created great interest in converting this material back to chlorine.

IN THE CHEMICAL PROCESS INDUSTRIES:

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... **Because USG Assures**
ACCURACY—DEPENDABILITY—QUALITY

There's no room for guesswork in selecting gauges to measure and control chemical, food and other processes. The preference shown for US Gauges by the majority of instrumentation men and chemical engineers is a reliable indication that US instruments give them more value . . . accuracy, dependability, quality.

They know that USG can supply gauges for all of their requirements however exacting . . . from highly specialized instruments measuring less than 1" of mercury absolute to standard type gauges measuring from 30" vacuum to 100,000 pounds pressure per square inch.

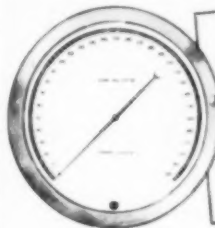
US Gauge's research and design engineers have pioneered the development of many new and improved gauges especially for application in the process industries. Get more information about these instruments now. Write today. Ask for a copy of the new USG catalog. No obligation. United States Gauge, Division of American Machine and Metals, Inc., Sellersville, Penna.



**US GAUGES—BETTER INSIDE...BETTER
OUTSIDE...BETTER ON YOUR PRODUCT**

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UNITED STATES GAUGE



LABORATORY TEST GAUGES

USG 12 and 16 inch laboratory test gauges are precision instruments frequently used to replace or augment dead-weight testers or manometers in ranges 15 lbs. to 20,000 lbs. Bourdon tubes are precision drawn phosphor bronze, beryllium copper or Type 403 stainless steel. Independent, replaceable nickel finished bronze movement has extra long bearings and heavy bushings. Accuracy is 1/2 of 1% of indicated readings above 20% of maximum dial range and 0.2% of full scale over the balance. Ranges 15 in. 20,000 lbs. P.S.I. Higher pressures on request.



DIAPHRAGM TYPE PRESSURE GAUGES

These gauges are ideally suited for use as air flow indicators, draft gauges, and liquid level indicators in shallow tanks. Diaphragm is of selected beryllium copper which is statically balanced. Frictionless movement with precision generated teeth and polished bearings. Dissimilar wear resistant metals are used throughout. Accuracy 1% of full scale. Ranges 10 inches water to 15 lbs. P.S.I.



VAPOR TENSION THERMOMETERS

Remote indicating thermometers for installation where the indicating head is to be located some distance from the temperature responsive bulb. Bourdon tubes are of beryllium copper. Precision geared movement is of brass construction throughout. Drawn copper bulb is connected to the indicating head with a specified length of soft copper capillary, reinforced with double wire braid throughout. For corrosive or high temperature applications bulb and capillary may be furnished in stainless steel. Cases are of cast brass. Dials are white with black numerals and graduations. A variety of ranges from minus 40° to plus 800° F.



PRODUCTS OF UNITED STATES GAUGE... Absolute Pressure Gauges • Aircraft Instruments • Air Volume Controls • Altitude Gauges • Boiler Gauges • Chemical Gauges • Dial Thermometers • Glass Tube Thermometers • Flow Meters • Inspectors' Test Gauges • Laboratory Standard Test Gauges • Marine, Ship and Air-Break Gauges • Recorders • Controls and Alarm Gauges • Voltmeters • Ammeters • Welding Gauges

U.S. INSTRUMENTS Test Your Skill
USG

UREA

Short supplies and large potential demand stirs up competition for Du Pont. Allied is building a new unit.

JOHN R. SKEEN

Urea has been in poor supply for nearly a decade. The production of many commodities was affected: adhesives, dyes, plastics, resins, textiles, such chemicals as ammonium sulphamate and sulphamic acid, and nitrogen fertilizers. In order to mitigate this situation, consumers secured significant amounts from Europe as soon as possible but at premium prices. In addition, new capacity was provided last August. It is reported that the supply deficit is now not great.

Urea is marketed in three forms. The high purity "crystal" is consumed industrially, mostly to make plastics and resins. A solid crude, variously diluted to prevent coalescence, is sold as Uramon. Several solutions in ammonia and water constitute the UAL liquors. Approximately 45,000 tons were made in 1939 of which a fifth was crystal. Four years later the output was more than doubled, 40 percent being for industry. Subsequently operations were limited by the inadequacy of the ammonia supply and the selectivity of the war demand. Last year it is said that the new supply exceeded 115,000 tons. Crystals are more than half.

The rise of the pure grade to its dominant position is ascribable in great part to the increased importance of urea resins. During the period 1938-40, less than 6,000 tons of urea were so used annually. The amount tripled during war years and subsequently increased still further. The new and promising use as a protein supplement for ruminants such as cattle and sheep has added to the supply burden. A high purity chemical is required provided with a conditioner and with nutritive values added.

Urea is made by reacting carbon dioxide and anhydrous ammonia in autoclaves at temperatures of about 200 deg. C. and pressures in excess of 150 atmospheres. Ammonia conversion is said to approach 80 percent. The immediate product, or "melt," may be directly converted into ammoniating liquor for fertilizers by the

addition of water. By distilling the gases and centrifuging, "crude" urea is obtained. This, when mixed with ground cocoa shells, phosphate rock or powdered dolomite in order to prevent cake formation, yields the solid fertilizer, Uramon. The crude is also purified and filtered to give industrial "crystal" urea.

Several technical difficulties attend operations. Urea is highly corrosive and necessitates the use of much silver-lined equipment.

Wohler announced the synthesis of urea in 1828. Since then over 50 methods have been suggested and the one employed today originated with Basaroff in 1868. Many efforts at commercial production ended in failure because of the high cost of ammonia, corrosion problems and other difficulties. First successful operations were at the Oppau plant in Germany where 46 percent urea was made.

The advent of cheaper ammonia in 1925 was a major stimulus to interest in urea. The economics of the process, however, favored the Germans. Thus, the conversion of ammonia was less than 50 percent. Either recycling was necessary or a market was required for the unreacted gas and carbamate. In Germany, a profitable market was found in the conversion of calcium

sulphate into the ammonium salt used for fertilizer. This compound was supplied domestically in ample amount as a byproduct of coke ovens and was an unattractive outlet. The solution to the problem depended upon the development of a market for ammoniating superphosphate in competition with anhydrous ammonia, per se. In this regard, UAL liquors presented evident advantages. In 1932, E. I. du Pont de Nemours & Co. made it.

Meantime, the demand for crystal had been growing. In the late 20's, the German products, Floramid and Calurea, were sold for fertilizer purposes. In 1929, the American Cyanamide Co. announced production of the new urea resin, Beetle. Others followed rapidly and world-wide trade relations were established in this field. Application in textile processing soon developed with Resinous Products and Chemical Co., perhaps, the domestic pioneer in 1933. About four years later still another outlet was found for making adhesives to bond plywood. The phthalocyanine dyes, developed in England, were produced by du Pont. Uses for urea multiplied and grew.

Imperial Chemical Industries, Ltd., of England first produced the industrial grade in 1935 in small amount. Late in that year, du Pont followed and remains the only domestic supplier. However, by the end of this year the Solvay Division of Allied Chemical and Dye Corp. is expected to be in production at its plant at South Point, Ohio. Capacity is reported at 170 tons per day. In addition, the Mississippi Chemical Corp. is considering production in the near future. At least two others have the manufacture of urea under consideration.

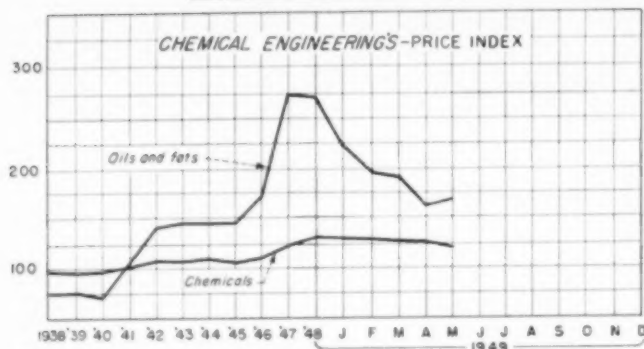
New statistics show urea's steady growth and downward price trend

	Total New Supply ¹	Industrial ¹ Crystal Production ²	Crystal Imports ²	Solid Production ³	Fertilizer ⁴ Crystal Imports ³	Liquid Production ³	Ammonia Required, Percent of U. S. Total ⁴	Price, 40% Dollars Per Ton ⁵
1935	14,000	600	3,935	.....	235	9,000	8%	95
1936	17,300	3,900	3,048	.....	333	10,000	9	95
1937	35,178	7,500	2,649	5,000	20	20,000	9	95
1938	36,600	5,000	1,258	15,000	292	15,000	9	95
1939	44,900	10,000	820	19,000	68	15,000	12.8	95
1940	75,000	15,000	.....	40,000	.....	20,000	.....	85
1941	69,000	25,000	.....	25,000	.....	19,000	12.2	85
1942	55,000	24,500	.....	14,200	.....	16,500	7.2	80
1943	92,400	38,350	.....	26,000	.....	28,000	7.1	77
1944	70,000	35,550	.....	14,000	.....	20,000	4.5	75
1945	71,000	36,000	.....	14,000	.....	21,000	.....	60
1946	81,000	44,000	.....	14,000	.....	23,000	.....	68
1947	88,300	47,000	1,266	17,000	.....	23,000	4.7	68
1948	>116,000	>60,000	9,521	20,000	.....	27,000	5.9	73

¹ Urea contents are approximations only except as noted.
² New supply equals the sum of urea content of domestic production and imports of all forms as cited; values "rounded" to nearest 100. ³ Crystal urea used for industrial purposes and the equivalent grade consumed as protein supplement for ruminant feed. ⁴ The solid crude urea, Uramon; containing close to 88 percent urea, about 2 percent ammoniac, carbamate and water, and the rest diluents; the liquid form U.A.L. A, B, 37, etc., containing from 20 percent to 43 percent urea. ⁵ The approximate amount of anhydrous ammonia required to produce domestic urea expressed as percent of domestic ammonia production.
⁶ Bags, carload lots, works. *Du Pont & Dug Report*. ⁷ Based upon trade reports, recapitulation of consuming uses, and three surveys: 1942-3-4; *Ind. Eng. Chem.*, June 1948, p. 975. ⁸ 1935-45. ⁹ *Foreign Commerce & Navigation of the U. S.*; see also "Urea," C. K. Horner, Industrial Reference Service, v. 3, pt. 2, No. 40, 1945; exclusive of Calurea & allied forms & presumably represents crystal almost entirely.
¹⁰ For consumption, see "Production & Fertilizer Use of Urea," Circular No. 679, Department of Agriculture, Oct. 1945; stocks of total fertilizer urea at end of 1941, were about 25,000 tons, mostly in the form of crude urea (i.e. for Uramon); it is said that stocks were about 20,000 tons at end of 1943 & have been only working inventories since 1945; see also "Capacity to Produce Nitrogen Compounds," W. C. Cope, *Chem. Eng. News*, 23, 246, 1945—allocations. ¹¹ Calurea; see Circular No. 679 and Urea (Reference 7).
¹² Roughly approximate only. ¹³ Imports in small amount resumed late in 1946 from the I. G. plant at Oppau.

JOHN R. SKEEN is market research director for Foster D. Snell, Inc.

PRODUCTION, CONSUMPTION AND PRICE TRENDS



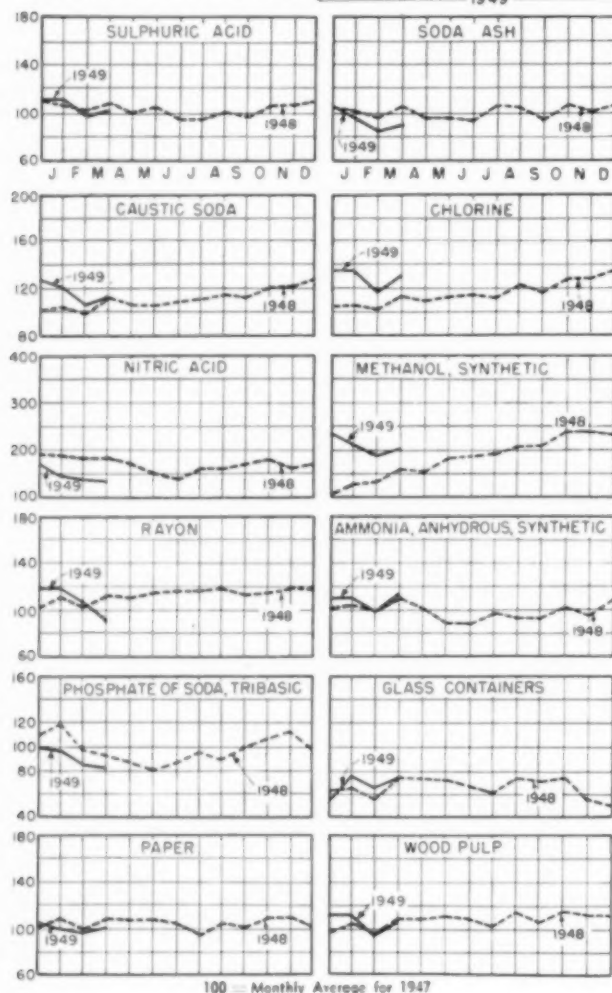
Weighted Index

Chemical Engineering

Index Prices

	Chemicals	Oils & Fats
As of June 1, 1949	123.29	166.27
Last month (rev. 1948)	125.69	167.96
June, 1948	131.00	208.81
June, 1947	123.38	227.60

1937 = 100



100 = Monthly Average for 1947

Price Trends

Prices continued their downward trek last month. Pigments, methanol, phenol, turpentine, calcium arsenate, metal salts of copper, lead and zinc, as well as tetraethyl lead followed the pattern.

Price supports were holding up the price of flaxseed last month. Commercial buyers pulled out of the market on May 31, and CCC reluctantly stepped in to fulfill its commitments. This is a record year and about 55 percent of the crop was marketed by the first of June, according to government officials. On June 1 the government also moved to dispose of its stocks of 250 million pounds of linseed oil and 18 million bushels of flaxseed. CCC paid \$6 per bu. for this seed and the current support price is about \$3.74 per bu. on a national average.

Production Trends

The seasonal slump in chemical production was accentuated this year by the effects of the current readjustment in business. With demand for chlorine at a high level, some producers are faced with the problem of finding bigger markets for their caustic soda. Other chemical producers are facing the same problem as traditional markets slacken or drop off temporarily.

The Tariff Commission has released the final figures on 1947 organic production. The data show that the sales value of all organics established a record of \$2.5 billion in that year. However, it is very probable that this official high mark was surpassed in 1948. More than 58 billion pounds were made in 1947. Over 550 manufacturers furnished reports in this survey covering their manufacture and sales of more than 6,000 chemicals and finished products.

June 1949—CHEMICAL ENGINEERING

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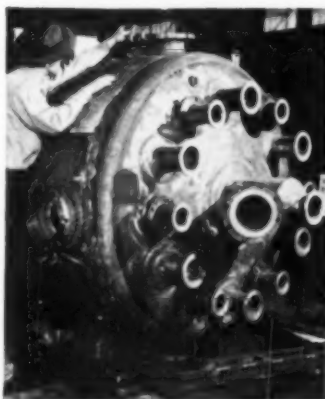
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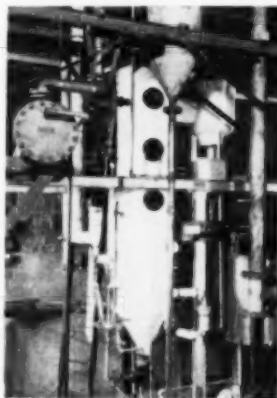
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United States Production of Certain Chemicals

Chemical (Tons unless otherwise noted)	January and February 1949, January and February 1948			
	January 1949	February 1949	January 1948	February 1948
Ammonia, synthetic, anhydrous	99,052	90,917	98,406	90,550
Ammonium nitrate	83,707	89,005	86,287	88,649
Ammonium sulphate, synthetic (M lb.)	67,770	69,975	58,883	51,712
Calcium acetate (M lb.)	81,919	86,490	80,091	85,006
Calcium carbide, commercial				
Calcium phosphates			6,038	5,703
Monohydrate (M lb.)			7,440	6,500
Dihydrate (M lb.)				
Carbon dioxide				
Liquid and gas (M lb.)	16,871	16,808	15,445	17,274
Solid (M lb.)	41,500	41,283	40,741	42,030
Chlorine	132,838	136,481	123,319	116,143
Chlorine gas (M lb.)	780	582	658	977
Chlorine yellow and orange, (C.P.) (M lb.)	3,958	2,410	4,075	3,807
Hydrochloric acid	39,378	39,194	39,232	33,940
Hydrogen (M cu. ft.)	2,552	2,293	2,201	2,119
Lead acetate, acid and basic (M lb.)	3,866	4,099	3,229	3,697
Molybdate chrome orange, (C.P.) (M lb.)	445	451		479
Nitric acid	97,834	90,545	101,324	100,546
Oxygen (M cu. ft.)	1,403	1,344	1,270	1,238
Phosphoric acid (50 percent H ₂ PO ₄)	112,257	107,335	95,304	90,901
Soda ash				
Ammonia-soda process				
Total wet and dry	372,224	329,076	383,481	360,437
Finished light	205,469	185,797	199,627	191,173
Finished dense	110,102	98,371	136,312	111,097
Natural	17,133	15,909	22,389	25,403
Sodium bicarbonate, refined	13,346	11,825	13,190	14,171
Sodium bicarbonate and chromate	8,913	7,987	7,664	7,106
Sodium hydroxide				
Electrolytic process				
Liquid	0,994	114,890	119,063	112,669
Solid	28,161	27,130	25,170	21,262
Lime-soda process				
Liquid	58,907	63,403	63,717	61,024
Solid	22,670	18,841	20,974	20,243
Sodium phosphate				
Monobasic	1,120	809	1,008	829
Dibasic	11,407	10,400	6,563	6,063
Tribasic	6,679	8,815	8,125	6,739
Meta	2,947	2,278	2,512	2,069
Tetra	6,162	6,808	4,949	5,103
Sodium sulphate, anhydrous	33,914	31,663	37,320	44,960
Sodium sulphate				
Anhydrous	16,306	12,628	13,015	12,296
Glauber's salt	14,712	13,640	18,437	15,534
Salt cake	27,756	22,900	31,842	28,525
Sulphuric acid				
Chamber process	247,908	221,796	287,323	274,047
Contact process, new	632,343	600,394	597,827	567,599

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census. Production figures represent primary production and do not include purchased or transferred materials. Quantities produced by government-owned enterprises, organizations, works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given data are either confidential or not yet available. Includes a small amount of aqua ammonia. Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finish light and finished dense. Not including quantities converted to finished dense. Data collected in cooperation with the Bureau of Mines. Figures represent total production of liquid materials, including quantities evaporated to solid caustic and reported as such. Includes oleum grades, excludes spent acid. Data for sulphuric acid manufactured as a byproduct of smelting operations are included.

United States Production of Synthetic Organic Chemicals

Chemical	January and February 1949, January and February 1948			
	January 1949	February 1949	January 1948	February 1948
Acetanilide	567,082	493,358	444,334	582,961
Acetic acid				
Crystallized	3,902,171	32,984,584	31,902,953	30,544,394
Recovered	130,608,315	125,093,345	142,756,204	126,085,765
Natural	2,344,903	1,854,174	2,296,288	2,079,052
Acetic anhydride	96,519,676	57,407,102	62,790,326	58,183,746
Acetone	63,418,156	35,834,942	36,944,596	33,342,525

(Continued on page 324)

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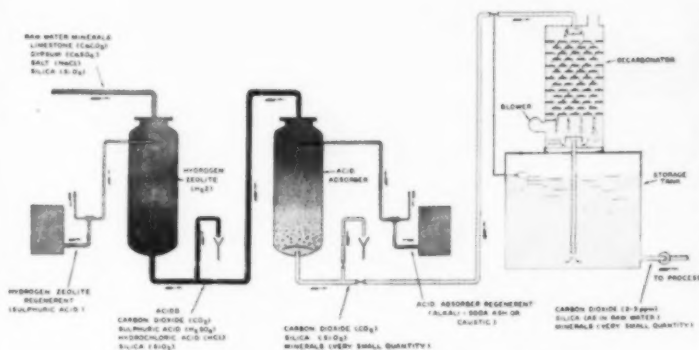
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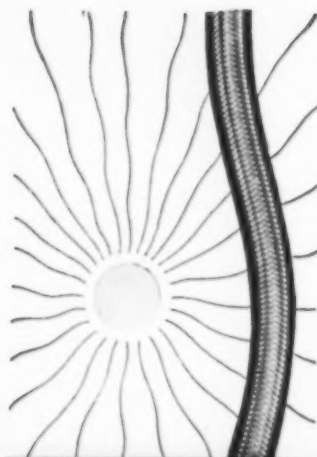
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U. S. Production of Synthetic Organic Chemicals, cont. from page 322

Chemical	January and February 1949		January and February 1948	
	January 1949	February 1949	January 1948	February 1948
Acrylonitrile acid	1,179,808	1,098,320	979,411	984,401
Aniline	7,136,417	6,583,215	9,498,617	7,443,059
Barbituric acid derivatives				
5-Ethyl-5-phenylbarbituric acid and salts (phenobarbital)	39,276	41,048	61,772	43,638
Benzene				
Motor grade				
Coke oven operators	647,940	713,645	1,210,717	836,788
All other grades				
Tar distillates	1,020,321	924,630	1,178,998	1,073,647
Coke oven operators	12,743,849	12,848,761	12,842,709	12,009,988
Butyl alcohol, primary, normal	10,448,920	11,163,937	11,140,280	9,900,117
Carbon bisulfide	36,750,734	31,911,533	30,159,133	30,733,299
Carbon tetrachloride	18,567,625	17,911,877	18,638,275	17,740,263
Chlorobenzene, monomer	28,511,102	23,172,697	29,100,846	26,210,077
Chloroform				
Tar distillates	10,884,728	11,507,569	9,503,262	8,809,830
Coke oven operators	2,252,712	1,927,615	3,332,032	3,115,502
Cresols, ortho-meta-para	666,585	807,312	582,903	710,969
Cresols, ortho-meta-para	967,667	854,959	611,428	625,654
Crotyle acid, refined	2,302,187	1,650,716	1,908,183	1,617,454
Dibutyl phthalate	1,036,611	967,549	2,638,814	911,088
Dichlorodiphenylmethane (DDT)	3,349,716	3,060,974	2,331,346	2,224,776
Ethyl acetate (95 percent)	6,381,019	5,633,222	8,290,782	3,711,863
Ethylene glycol	33,908,347	33,021,091	23,907,336	26,961,565
Ethyl ether	2,741,231	3,078,330	2,424,177	3,181,100
Formaldehyde, 37 percent by wt.	48,875,043	43,869,453	33,497,372	31,927,967
Hexachlorocyclopentadiene	1,159,785	1,212,513	1,317,068	1,352,282
Methanol, natural	1,314,663	1,141,529	1,485,382	1,312,535
Methanol, synthetic	96,320,798	84,980,153	58,472,357	60,829,313
Naphthalene				
Tar distillates, less than 79° C.	23,469,765	11,616,181	14,142,778	17,960,905
Tar distillates, 79° C. and over	7,223,029	7,199,771	9,406,380	8,290,687
Coke oven operators, less than 79° C.	8,979,431	8,292,635	8,531,934	8,129,490
Coke oven operators, 79° C. and over	10,518,919	9,793,388	6,601,355	7,057,264
Phenol	26,767,011	21,279,944	25,971,126	26,721,209
Purified acetylene	16,294,507	12,814,533	12,433,117	11,047,501
Styrene, government and private plant	33,015,962	29,132,731	26,005,410	26,966,520
Toluene				
Coke oven operators	2,540,396	2,445,520	2,427,900	2,304,878
All other	3,678,468	4,142,706	3,744,034	5,561,714
Xylene crude	4,812,833	4,307,276	3,317,569	5,027,712

All data in pounds except benzene (gal.) cresosote oil (gal.), toluene (gal.) xylene (gal.) and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. *Excludes the statistics on recovered acid. *Acid produced by direct process from wood and from calcium acetate. *All acetic anhydride including that from acetic by vapor-phase process. *Product of distillers who use purchased coal tar only or from oil-gas or water-gas produced or purchased by tar distillers. *Statistics are given in terms of bulk medicinals only. *Statistics collected by Bureau of Mines. *Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. *Reported to U. S. Bureau of the Census. *Includes toluene produced from petroleum by any process. *Includes refined crotylic acid from petroleum.

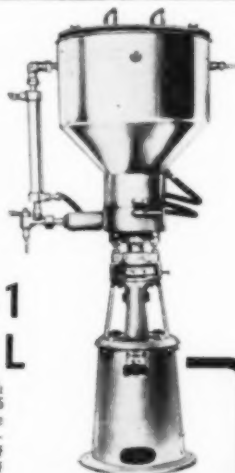
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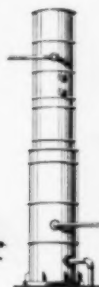
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Calif., South Gate—Parex Corp., Ltd., 9300 Rays Ave., manufacturer of bleach softeners, plans to construct a 1 story, 8½x101 ft. factory. David R. Edwards, 591 Pine Ave., Maywood, Calif., Engr. Estimated cost \$100,000.

Del., Seaford—E. I. du Pont de Nemours & Co., Inc., Nemours Bldg., Wilmington, plans to enlarge its nylon plant here. Estimated cost \$250,000.

La., Baton Rouge—Standard Oil Co. of New Jersey, North Baton Rouge, plans to construct a 1 story, 26x84 ft. change house at the Esso Refinery.

Miss., Cleveland—Baxter Laboratories, Inc., Morton Grove, Ill., plans to construct a manufacturing plant. Estimated cost \$500,000.

S. C., North Charleston—West Virginia Pulp & Paper Co., North Charleston, plans to construct additional plant facilities to include new chemical recovery unit, lime kiln, turbine boiler and boiler and barking drum. Estimated cost \$1,140,000, \$450,000, \$2,600,000 and \$250,000 respectively.

Tex., Houston—Phillips Chemical Co., City Natl. Bank Bldg., plans to enlarge its fertilizer plant. Estimated cost \$500,000.

Tex., Rio Grande—Continental Oil Co., Ponca City, Okla., plans to enlarge its natural gasoline plant. Estimated cost \$1,500,000.

W. Va., Hastings—Carbide & Carbon Chemical Corp., 30 East 42nd St., New York, N. Y., plans to construct three 1 story additions to its chemical plant here. Ford, Bacon & Davis, 39 Bway, New York, N. Y., Consult. Engrs. Estimated cost \$250,000.

Que., Montreal—Canada Oil Companies Ltd., 204 Richmond St., W., Toronto, Ont., plans to construct a lubricating oil blending and grease manufacturing plant at terminal plant on Notre Dame St. Estimated cost \$1,500,000.

Contracts Awarded

Fla., Miami—American Oil Co., 2900 N. W. 24th St., will construct a warehouse and office building. Work will be done by owners. Estimated cost \$68,000.

Ill., Chicago—Gazzola Drug & Chemical Co., 121 South Green St., has awarded the contract for a 4 story, 35x71 ft. plant to J. Emil Anderson & Son, 1809 West Belmont St. Estimated cost \$125,000.

Ill., Cicero—Cities Service Oil Co., 70 Pine St., New York 5, N. Y., has awarded the contract for the construction of a plant unit to have a capacity of 23,000,000 gal. to Sumner S. Sullitt & Co., 307 North Michigan Ave., Chicago. Estimated cost \$4,000,000.

Ill., West Chicago—Northwestern Chemical Co., 410 North Michigan Ave., Chicago, has awarded the contract for a 3 story factory containing 120,000 sq. ft., to Ragner Benson, Inc., 4744 West Rice St., Chicago. Estimated cost \$300,000.

	Current Projects		Cumulative 1949	
	Proposed Work	Contracts	Proposed Work	Contracts
New England.....	808,000	8274,000	81,380,000	81,380,000
Middle Atlantic.....	2,600,000	158,483,000	6,204,000	6,204,000
South.....	5,258,000	2,808,000	8,951,000	22,694,000
Middle West.....	4,625,000	11,654,000	28,516,000	28,516,000
West of Mississippi.....	2,000,000	5,245,000	36,443,000	35,765,000
Far West.....	100,000	70,000	3,925,000	1,548,000
Canada.....	1,500,000	8,870,000	29,315,000	56,270,000
Total.....	89,108,000	\$24,346,000	\$249,045,000	\$152,257,000

Kan., Deerfield—Deerfield Petroleum, Inc., Deerfield, will construct a new plant. Work will be done with own forces. Estimated cost \$100,000.

Ky., Louisville—National Distillers Products, 1378 Lexington Rd., has awarded the contract for the design and construction of a warehouse addition to Sanderson & Porter, 1373 Lexington Rd. Estimated cost \$1,800,000.

Mass., Chelsea—Panca Rubber Co., 31 Highland St., has awarded the contract for the construction of a warehouse and office building to Jefferson Construction Co., 71 First St., Cambridge. Estimated cost \$68,000.

Miss., Yazoo City—Mississippi Chemical Corp., c/o The Girdler Corp., 224 East Bway, Louisville, Ky., contractor, will construct an anhydrous ammonia plant. Estimated cost \$1,000,000.

Nev., Gerlach—U. S. Gypsum Co., 300 West Adams St., Chicago, Ill., has awarded the contract for the construction of a plasterboard factory to Dodge Construction Co., North Main St., Fallon. Estimated cost \$70,000.

N. J., Camden—H. Kohnstamm & Co., Lemuel and Lois Aves., color manufacturers, will alter and rebuild three of its factory buildings. Work will be done by separate contracts. Estimated cost \$100,000.

N. J., Raritan Twp.—Johnson & Johnson, 500 George St., New Brunswick, has awarded the contract for a shipping center, warehouse and office to John W. Ryan Construction Co., 369 Lexington Ave., New York, N. Y. Estimated cost \$1,500,000.

N. J., Westville—Freeport Sulphur Co., 122 East 42nd St., New York, N. Y., has awarded the contract for a 40 ton per day sulphur recovery plant to produce elemental sulphur from hydrogen sulphide contained in waste gases from several process units of Texas Company's Eagle Point Refinery here to Girdler Corp., 224 East Bway, Louisville, Ky.

Okla., Alex—Magnolia Petroleum Co., Magnolia Bldg., Dallas, Tex., has awarded the contract for a 35,000,000 cu. ft. capacity daily pressure maintenance and recycling plant in Chitwood gas field, Grady Co., to include four 850 hp. compressor units and wet gas extraction units to Construction Service Co., M & M Bldg., Houston, Tex. Estimated cost \$375,000.

Okla., Cushing—Deep Rock Oil Co., Atlas Bldg., Tulsa, has awarded the contract for a 5,000 bbl. per day fluid catalytic cracking plant to Jones & Laughlin Supply Co., 105

North Trenton St., Tulsa. Estimated cost \$2,000,000.

Tex., Decatur—Cities Service Oil Co., Bartlesville, Okla., will construct a casinghead gasoline plant. Work will be done with own forces. Estimated cost \$750,000.

Tex., Howe—Lone Star Gas Co., 1917 Wood St., Dallas, will construct a 5,620 hp. compressor station. Work will be done with own forces. Estimated cost \$275,000.

Tex., Jourdanton—Humble Oil & Refining Co., Humble Bldg., Houston, has awarded the contract for the construction of a compression and absorption plant to Hudson Engineering Corp., 2711 Danville St., Houston. Estimated cost \$1,750,000.

Alta., Calgary—Pacific Petroleum, Inc., Frank McMahon, Pres., Calgary, will develop the gas deposits in Alberta. Work will be done with own forces. Estimated cost \$1,000,000.

Alta., Leduc—Imperial Oil, Ltd., 50 Church St., Toronto, Ont., has awarded the contract for the construction of a compressor station and gasoline absorption plant in the Leduc Oil Fields, to C. F. Braun Co., Inc., Alhambra, Calif., U.S.A. Estimated cost \$6,500,000.

Que., Arvida—Aluminum Co. of Canada, Ltd., Sun Life Bldg., Montreal, has awarded the contract for the construction of a 2 story, 50x200 ft., and 2 story, 60x200 ft. extension at the east end of its laboratory and a 1 story, 50x110 ft. extension at west end to Foundation Co. of Canada, Ltd., 1900 Sherbrooke St., W., Montreal. Estimated cost \$1,000,000.

Ont., Cornwall—Canadian Industries, Ltd., 1135 Beaver Hall Hill, Montreal, Que., has awarded the contract for the construction of a chlorine concentrating plant and shipping building to A. E. Farley Construction Co., Ltd., 30 Russell Ave., Ottawa. Estimated cost \$100,000.

Ont., Thornhill—Brikcrete Associates of Canada, Ltd., 9 Toronto St., Toronto, has awarded the contract for a construction of a plant for the manufacture of "brikcrete" to James France and owner's staff. Estimated cost \$70,000.

Que., Valleyfield—Merck & Co., Ltd., 560 de Concellas St., Montreal, has awarded the contract for the superstructure of proposed chemical plant to R. Belanger, 47 Jacques Cartier St. Estimated cost \$100,000.

Ont., Toronto—Dominion Corrugated Paper Co., Ltd., 142 Weston Rd., will construct a factory by day labor. Estimated cost \$100,000.



TURBINE TIPS

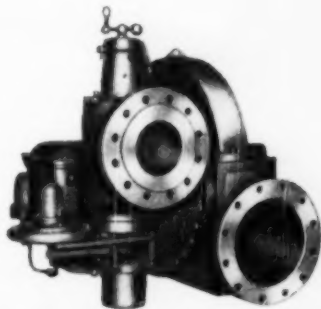
no. 1

question:

Are turbines a good choice for variable speed drives? . . .

answer:

Yes. For instance, in cases where automatic speed control is desired, many pump, fan and compressor drives are equipped with either an air motor regulator (as shown) or a remote governing valve. With such an arrangement speed may be automatically controlled in terms of such variables as pump discharge pressure, differential pressure, temperature, etc.



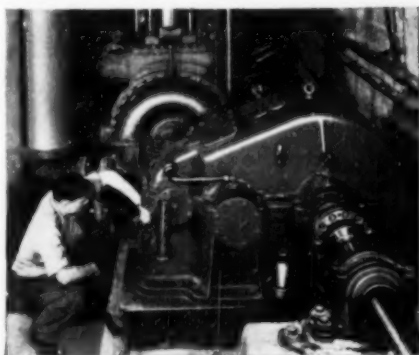
STANDARD TYPE DP TURBINE WITH REGULATOR

question:

What kind of turbine should be selected for hand control of variable speed drives? . . .

answer:

Several designs of General Electric governors are available, making it possible to obtain any desired speed range by either hand adjustment or push-button adjustment in case remote operation is desired. For instance, on this line shaft drive, the electric governor permits speed ranges as great as 20 to 1. With the new Type DR turbine, speed ranges up to 5 to 1 may be obtained. However, the standard Type DP turbine (30% range) will meet the requirements of most applications. On this machine you get totally enclosed, hydraulic governing—in addition to many other outstanding features—at no increase in cost.



question:

Where can I "get the facts" when considering a turbine application? . . .

answer:

Just call or write the nearest G-E Apparatus Sales Office. Your G-E sales engineer will gladly give you complete data on the application of turbines to your mechanical drives—and full information on the many outstanding features standardized in G-E turbines. Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

GENERAL  ELECTRIC

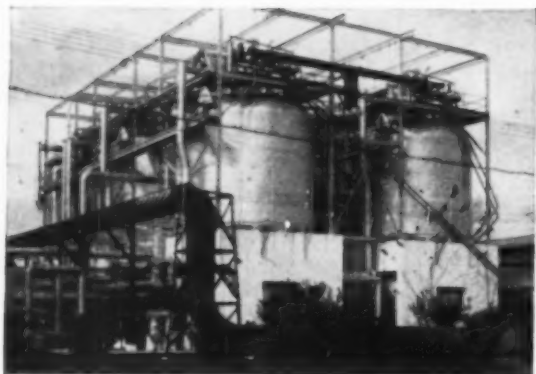
SULPHUR

**Interesting Facts Concerning This Basic
Raw Material from the Gulf Coast Region*

*SUPERHEATED WATER...

Mining operations are most successfully carried out if the water pumped

into the sulphur deposit is heated under pressure to a temperature of about 320° F. For large scale mining, enormous quantities of water are required, so, a primary requisite is an adequate supply of suitable water and an efficient power plant in which to heat it.



To insure a continuous supply of water at Newgulf, it is the practice to use river water pumped in time of flood or full flow and stored in large reservoirs. This supply is supplemented, when necessary, with well water. Water so obtained is seldom suitable for use in boilers or mine water heaters without being treated first because of natural salts in solution. Softening by chemical treatment is necessary to prevent deposition of scale on boiler tubes and hot water lines.

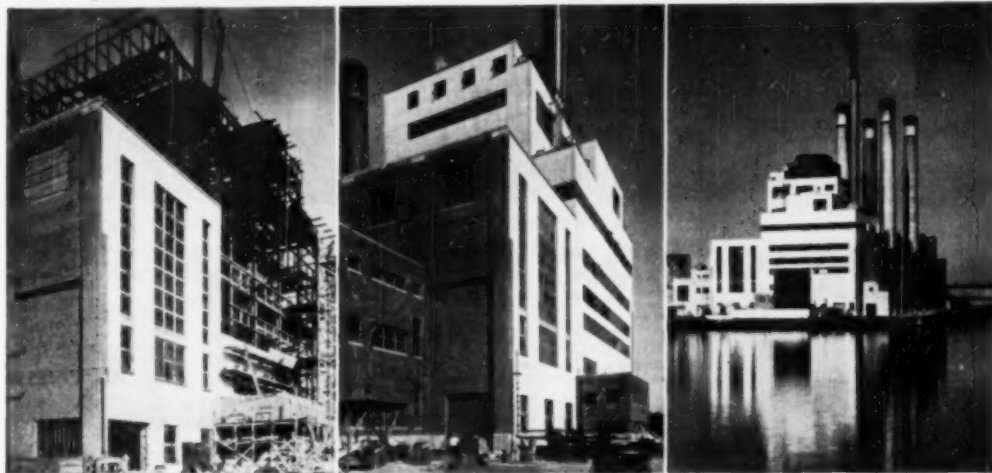
Loading operations at one of the huge vats of Sulphur at our Newgulf, Texas mine. Such mountains of Sulphur are constantly being built at our mines, from which shipments are continually made.



TEXAS GULF SULPHUR CO.
75 East 45th St.  New York 17, N. Y. **INC.**
Mines: Newgulf and Moss Bluff, Texas

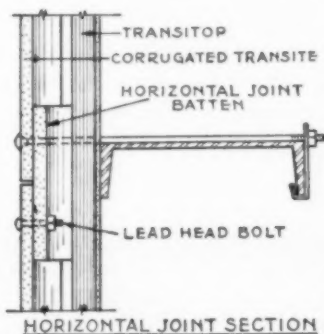
CORRUGATED TRANSITE ... for Curtain Walls

*Transite is a registered Johns-Manville trade mark



The United Illuminating Co., New Haven, Conn.; Westcott and Mapes, architects and engineers

Asbestos Corrugated Transite reduces load-bearing factor 83% on new power plant addition! Transite sheets give attractive, streamlined appearance... and they can't rot, rust, or burn.



● Here's a case in which a unique form of asbestos wall construction solved a tough building problem.

The addition planned was to be almost twice the height of the original building, yet where the two joined, existing foundations were to be used. This meant that the new bearing wall with all its extra height should weigh no more than the old wall.

After careful study, it was decided to use the Johns-Manville Industrial Curtain Wall, a system of dry wall construction which combines J-M Corrugated Asbestos Transite with J-M Transitop (Insulating Board faced with Flexboard).

This type of construction, compared with solid masonry, reduced the load-bearing factor from 120 to 20 pounds per square foot! It also provided fire protection, insulation, and permitted the use of less extensive pilings and foundations for the rest of the building.

Architects and engineers are constantly discovering new uses for J-M Corrugated Asbestos Transite, not the least of which is its surprisingly effective function in attractive, modern design.

Send for new brochure which may help you on your next project. Johns-Manville, Box 290, New York 16, N. Y.



EASY TO BOLT TO STEEL



EASY TO SAW



EASY TO DRILL



EASY TO NAIL TO WOOD



Johns-Manville

Asbestos

CORRUGATED TRANSITE

If
it Must be

...here, for your selection, are a variety
of filter types, all well-proved in the
field of pressure filtration.

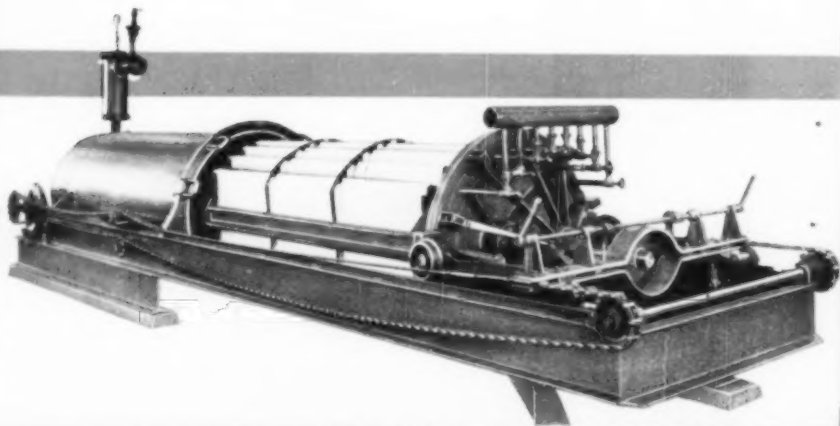
PRESSURE FILTRATION

First thoughts on filtration naturally are "continuous vacuum" and rightly so because with continuous vacuum filtration you get the automatic handling and steady production that helps so much to reduce filtration costs. But occasionally the products being filtered are such that they just can't be handled properly or economically on a continuous vacuum filter. Under such conditions, pressure filtration is a "must."

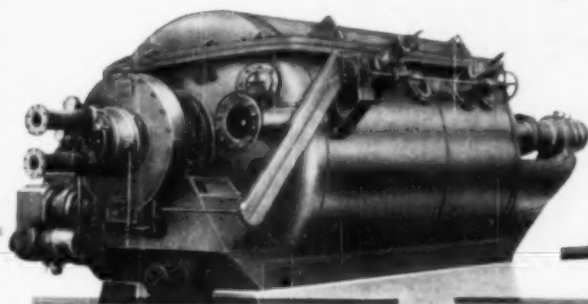
Oliver United, widely known for its extensive line of continuous vacuum filters, offers you the most complete line of filters and with it something even more important—the broadest experience in filtration. It's the experience that covers the three principles of filtration: batch pressure, continuous pressure and continuous vacuum. It's an experience that dates back more than forty years.

KELLY PRESSURE FILTER

Designed especially for extra high pressure work or where jacketing for high or low temperature work is required; especially large capacity for floor space required; dry cake can be removed by dumping after rolling out the filter element rack; or it can be sluiced down with the shell remaining closed; sizes 50 to 1300 sq. ft. of filter area. Twin units with larger area available.

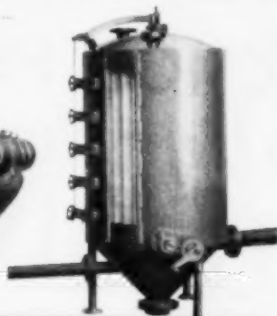


OLIVER UNITED



OLIVER PRESSURE PRECOAT FILTER

For "difficult-to-filter" solutions requiring pressure filtration; excellent for filtering products in solvent solutions at elevated temperatures or products with low percentage of solids; filter operates continuously with fresh surface of "precoat" of microporous permeable material such as diatomaceous earth for filtration; cake continuously shaved off with thin film of precoat thus preventing blinding of the precoat. Sizes up to 165 sq. ft. of filter area.



OLIVER-BEATTY PRESSURE FILTER

An excellent compact, clarifying filter with radially spaced leaves which can be rotated manually or by power for sluice cleaning the cake from the filter leaves by means of the loading and trailing moveable sluicing spray; side filtrate outlet; bottom cake discharge; standard precoating methods apply; sterilization simple; corrosion resisting construction available; one size, 300 sq. ft. filter area.

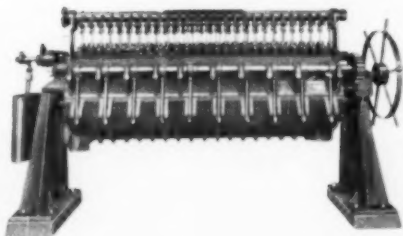


OLIVER PRESSURE FILTER

Complements the Oliver-Beatty Filter for clarifying and pelleting chemicals, fruit juices, dyes, syrups, beverages, latex, etc.; pressure up to 50 pounds; filter leaves parallel, removed from top; standard precoating methods apply; sterilizing simple; sight glasses for checking flow from each leaf; when needed, contact parts are constructed of corrosion resisting materials; 3 sizes: 50, 60 and 110 sq. ft.

Of the Pressure Filters available, those illustrated are the most widely used. Pressure requirements range from a few pounds to several hundred pounds. They are available in a variety of corrosion-resisting materials. They can be lagged or jacketed as in the case of the Kelly Filter. They are quite flexible in capacity because of permissible variations in leaf spacing.

With Oliver United, consideration of your problem is not limited to only one type of filter. Oliver United Engineers can select from (1) batch pressure filters, (2) continuous pressure filters, and (3) continuous vacuum filters... something quite unusual in filtration circles.



SWEETLAND PRESSURE FILTER

Industry's standard batch pressure filter suitable for most pressure filtration requirements; pressures up to 50 pounds; either top or bottom drainage filter leaves; individual sight glasses for checking flow from each leaf; high filtering rates and ease of handling cake for disposal; sizes range from 10 to 1044 sq. ft. of filter area.

New York 18, N. Y.
12 West 42nd Street

Chicago 1, Ill.
137 N. LaSalle Street

San Francisco 15
California

Western Sales Division
Oakland 1, Calif.
1900 Broadway Tower

Sole & Manufacturing Representatives:

R. Long, Limited
Vancouver, British Columbia, Canada

Factories: Oakland, Calif.
Washington, Pa. • Ovilla, Canada
Melbourne, Australia

FILTERS INC.

VALVE ACTION PERFECT! *Naturally - they're all* **POWELL VALVES**

Faulty valve performance can be as serious in the industrial plant as it is in the human heart.

Today, many plants throughout the United States have eliminated valve trouble by standardizing on Powell Valves. That's because, in designing every valve in the complete Powell Line, maximum performance at a minimum cost of maintenance has been a prime consideration. Also, because there's a Powell Valve specifically adapted to every known flow control requirement, failures due to misapplication are avoided.

So, whether you're making a new installation or need replacements, be sure to specify Powell Valves. And remember Powell Engineering Service is always at your disposal in selecting the correct valves to meet your individual requirements.

Belloys Sealed "Y" Valve. Powell's Belloys Sealed Valves—Globe and "Y" patterns—are designed for high vacuum service and for installations where packing is unsatisfactory or fails frequently. The belloys is encased within the valve body, completely sealing the interior of the valve from the outside atmosphere. Available in 18-8S, 16-8S Mo., Monel Metal, Hastelloy, in sizes $\frac{1}{4}$ " to 12", inclusive.



Fig. 2429—150-pound Stainless Steel Globe Valve with flanged ends, bolted flanged yoke and outside screw stem.

POWELL

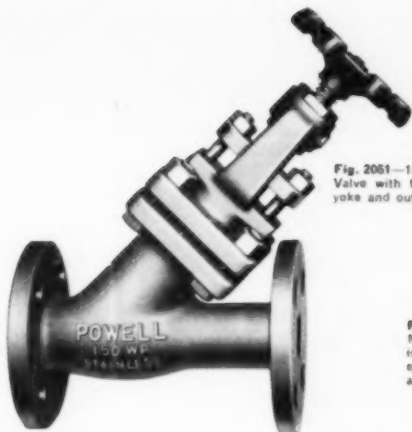


Fig. 2081—150-pound Stainless Steel "Y" Valve with flanged ends, bolted flanged yoke and outside screw rising stem.

Fig. 1793—Large 125-pound Iron Body Bronze Mounted Gate Valve. Made in sizes 2" to 30", inclusive. Has outside screw rising stem, bolted flanged yoke and tapered solid wedge. Also available in All Iron for process lines.

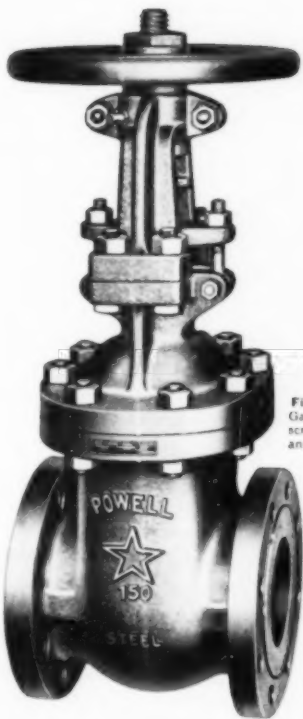


Fig. 1563—Class 150-pound Cast Steel Gate Valve with flanged ends, outside screw rising stem, bolted flanged yoke and tapered solid wedge.



Fig. 1700—200-pound Bronze Globe Valve with screwed ends, union bonnet, renewable, specially heat treated stainless steel seat and regrindable, renewable, wear-resisting "Powellium" nickel-bronze disc.

Powell Valves are made in Bronze, Iron, Steel and a wide selection of Corrosion-Resistant metals and alloys. Valves of every type—Globe, Angle, Gate, Check, Non-return and Flush Bottom Tank Valves—are included in the Complete Powell Line.

The Wm. Powell Company
Cincinnati 22, Ohio

DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

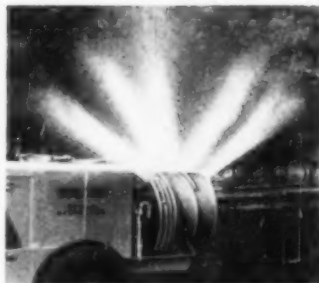
VALVES



THE NAME TO WATCH IN CHEMICALS

YOUR PRODUCT MAY NEED ORONITE POLYBUTENES

These pale colored, chemically inert liquids of moderate to high viscosity and tackiness offer many advantages in the formulation of a wide variety of products. They are available in eight grades of viscosity to meet specialized conditions. Their properties include exceptional stability, bodying, high dielectric strength, tackiness, moisture resistance, elasticity, to name a few. Products such as adhesives, inks, leather, electronic parts, sealing compounds, insecticides, rubber and many others are being greatly improved with Oronite Polybutenes. New important uses are continually being found for Polybutenes in an ever increasing number of industries. Detailed information gladly furnished from the Oronite office nearest you.



Improving adhesion and moisture resistance of insecticides and fungicides is one of the many important applications of Oronite Polybutenes. This versatile product increases the effective life of agricultural dusts and sprays. Its adhesive properties help reduce losses in spraying operations. Also, insecticides compounded with Oronite Polybutenes have high resistance to weathering.

ORONITE CHEMICAL COMPANY

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STANDARD OIL BLDG., LOS ANGELES 15, CALIFORNIA

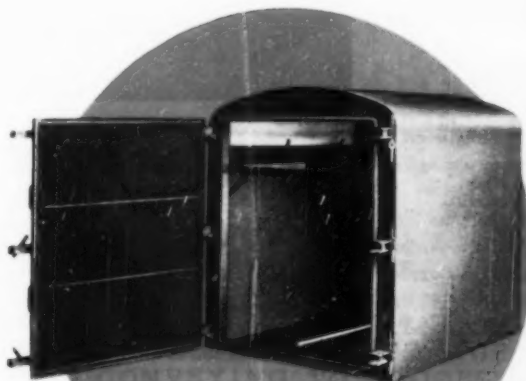
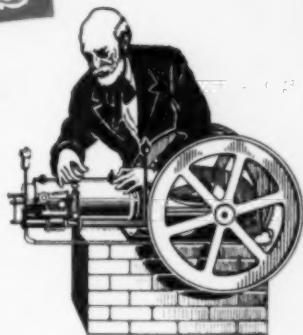
30 ROCKEFELLER PLAZA, NEW YORK 20, NEW YORK
600 S. MICHIGAN AVENUE, CHICAGO 5, ILLINOIS

BACK IN THE 1880's

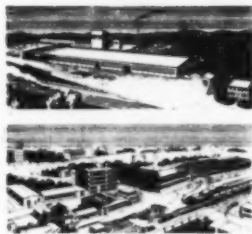
WHEN DAIMLER INVENTED
THE GASOLINE ENGINE

Koven

WAS MAKING INDIVIDUALIZED
CHEMICAL EQUIPMENT



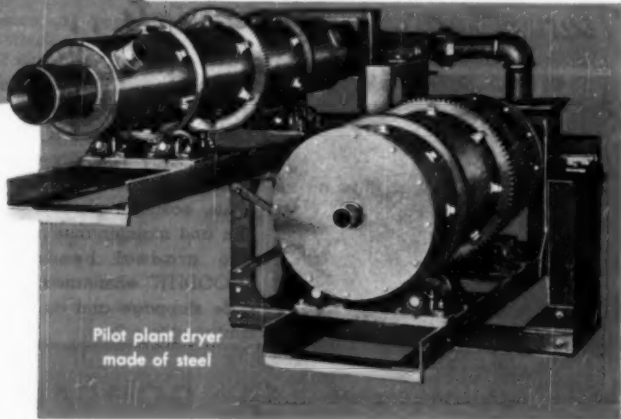
Steel drying oven



Plants

Jersey City, N. J.

Dover, N. J.



Pilot plant dryer
made of steel

The first internal combustion engine using gasoline was developed over 60 years ago. As far back as then, KOVEN engineers were designing and building individualized chemical equipment which effected vast changes in the pace of chemical production by increasing efficiency and decreasing costs. Today, even more, KOVEN-built units, made to meet your specific requirements, are vital time and money-savers. Without obligation, one of our representatives will explain how KOVEN experience can be of help in solving your production problems. Our complete, modern facilities include machine, sheet and plate, welding and galvanizing shops, and X-ray inspection. Call or write KOVEN now.

KOVEN equipment in all commercial metals and alloys includes: pressure vessels, extractors, mixers, stills, condensers, kettles, tanks, chutes, containers, stacks, coils.

L. O. KOVEN & BRO., INC.

154 Ogden Ave., Jersey City 7, N. J.

KOVEN FOR INDIVIDUALIZED CHEMICAL EQUIPMENT SINCE 1881



"GOODITE"

*Carries the Load
.... in Unique
Installation!*

Rubber Replaces Steel in Unusual Fly Ash Disposal System...

Abrasion being too tough for steel pipe to withstand, engineers at a large Chemical Plant turned to rubber and Goodall to solve the problem of the disposal of fly ash.

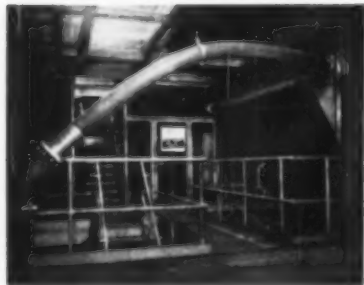
Fly Ash, a highly abrasive, hot retort residue, had easily cut through the steel disposal pipe, causing costly shutdowns and repairs. Engineers, faced with the question of economical operation, found their answer in Goodall's "GOODITE" Pipe. Installation of over 2000 ft. of 4" and 6" "GOODITE", replacing conventional steel pipe, proved the wisdom of their decision.



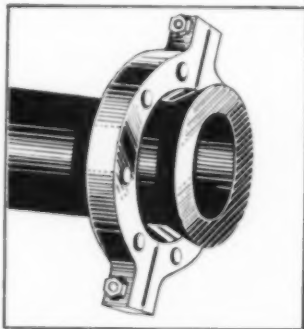
"FLANG-LOK" FLANGES

A special "GOODITE" feature that simplifies installation, as flanges need only be turned to align bolt holes. Patented construction insures a leakproof rubber-to-rubber seal, with no metal parts exposed to the action of abrasive ash.

Many Bends... Few Joints...



The highly resilient tube in "GOODITE" Pipe easily withstood the cutting action of fly ash, and the flexibility eliminated many intermediate joints, easing both installation and maintenance costs. The gradual bends of "GOODITE" eliminated possible stoppage and assured continual free flow.



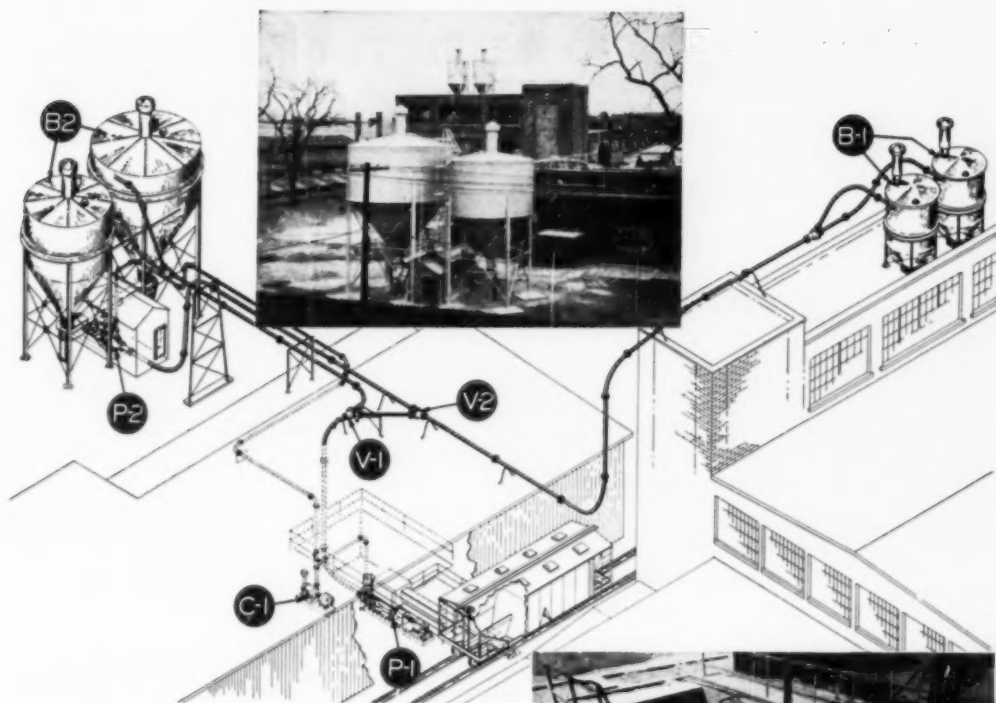
CONSULT Our Engineering Department regarding the profitable advantages of "GOODITE" Pipe for handling a wide variety of chemicals and abrasives, hot or cold, wet or dry. No obligation.



Est. 1878

GOODALL RUBBER COMPANY

GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.
Branches: Philadelphia • New York • Boston • Pittsburgh • Chicago • St. Paul • Los Angeles
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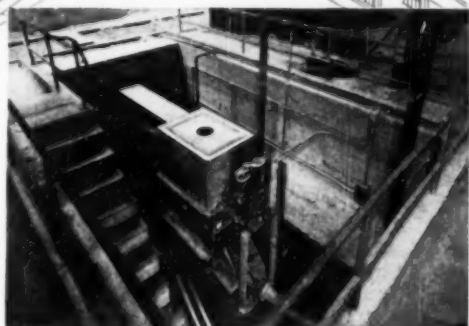


FULLER-KINYON SYSTEMS UNLOADING FROM CARS . . . CONVEYING DIRECT TO PROCESS OR STORAGE . . . RECLAIMING FROM STORAGE AND CONVEYING TO PROCESS

The installation illustrated is used for unloading and conveying Portland cement and filler dust in an asbestos shingle plant. These systems, installed in an existing plant, were designed and built to service process equipment and provide for future expansion.

One system (P-1) unloads materials from hopper bottom cars and conveys, through the use of two-way diverting valves (V-1 and V-2), direct to process bins (B-1) on top of building, or to reserve storage bins (B-2) in the yard. A second system (P-2) conveys materials from the storage bins (B-2) to process bins (B-1). A very flexible and simple system, economically possible only with Fuller-Kinyon.

A Fuller Rotary Single-stage Compressor (C-1) furnishes air for either conveying system, capacity 282 c.f.m., 25-lb. pressure. Air, where and when needed, and at the right pressure to do the work most economically and efficiently.



When your problem is conveying dry pulverized, crushed and granular materials, get in touch with us. Our engineering department is at your service . . . no obligation on your part.

FULLER COMPANY
CATASAUQUA - PENNSYLVANIA

Chicago 3 - 120 So. LaSalle St.
San Francisco 4 - 420 Chancery Bldg.



FULLER-KINYON, FULLER-FLUXO AND THE AIRVEYOR CONVEYING SYSTEMS
ROTARY FEEDERS AND DISCHARGE GATES ROTARY AIR COMPRESSORS
AND VACUUM PUMPS AIR-QUENCHING INCLINED GRATE COOLERS DRY
PULVERIZED MATERIAL COOLER AERATION UNITS MATERIAL LEVEL
INDICATORS MOTION SAFETY SWITCH SLURRY VALVES SAMPLERS

P-97

LEAD VALVES

Control Hungry Acids



Chem Rayon
"Y" Pattern



Type C
"Y" Pattern



Wedge Type
Gate Pattern



Type D Check



Chem Rayon
Angle Pattern



Diaphragm Pattern



Type R
Reversible Angle or "Y"

Men who need to tame biting acids and put them to useful work have long relied on lead. And they look to the leader in lead . . . National Lead Company . . . for dependable lead and lead-lined acid valves.

National Lead's "United" valves work efficiently at their routine jobs of controlling the flow of corrosive acids. But they also have the built-in stamina and sturdiness to withstand stresses and overloads well beyond their regular lines of duty.

The "United" valve you buy is representative not only of National Lead's resources in the lead products manufacturing field but also of resourcefulness in designing acid valves that make the most of lead's inherent corrosion-resistant properties.

Under the name "United," National Lead Company offers a complete line of hard lead and lead-lined flanged acid valves—"Y" and angle patterns, gate, check, foot and diaphragm.

Look to the Leader for Lead

...in everything from lead pipe...valves...sheet...and lead-lined or lead-covered equipment...to complete acid recovery plants

NATIONAL Lead Company



New York 6; Baltimore 3; Buffalo 3; Chicago 5; Cincinnati 3; Cleveland 13; Pittsburgh 12; St. Louis 1; Boston 6; National Lead Company of Mass.; Los Angeles 25; Morris P. Kirk & Son, Inc.; Philadelphia 25; John T. Lewis & Bros. Co.; Western Georgia Lead Works, Div. of Cincinnati Brassworks; Toronto, Canada (Canada Metal Co. Ltd.).

THIS LIQUEFIED PETROLEUM GAS INSTALLATION...



Photos courtesy H. EMERSON THOMAS & Associates



**"IS ONE OF THE FINEST
PLANTS IN THE STATE
OF OHIO"***

THE ABOVE PHOTOS show a very fine installation of DOWNTOWN Tanks for Propane Storage . . . which was made at the plant of Lustron Corporation in Columbus, Ohio.

* The quoted subhead is an excerpt of a letter from the State of Ohio, Dept. of Commerce, Division of State Fire Marshal, Columbus, to H. Emerson Thomas and Associates, Westfield, New Jersey (who designed and installed this installation for Lustron).

We of DOWNTOWN, having manufactured the Tanks, consider the quotation from this letter to be an excellent tribute. To fabricate work satisfactorily as above pictured, it is necessary to know proper welding procedures; correct choice of welding electrodes for various types of metals, etc.

To accomplish this purpose, Downtown has pre-determined welding procedures (which are constantly checked and improved); a welding supervisor, X-Ray and other technicians studying materials and methods.

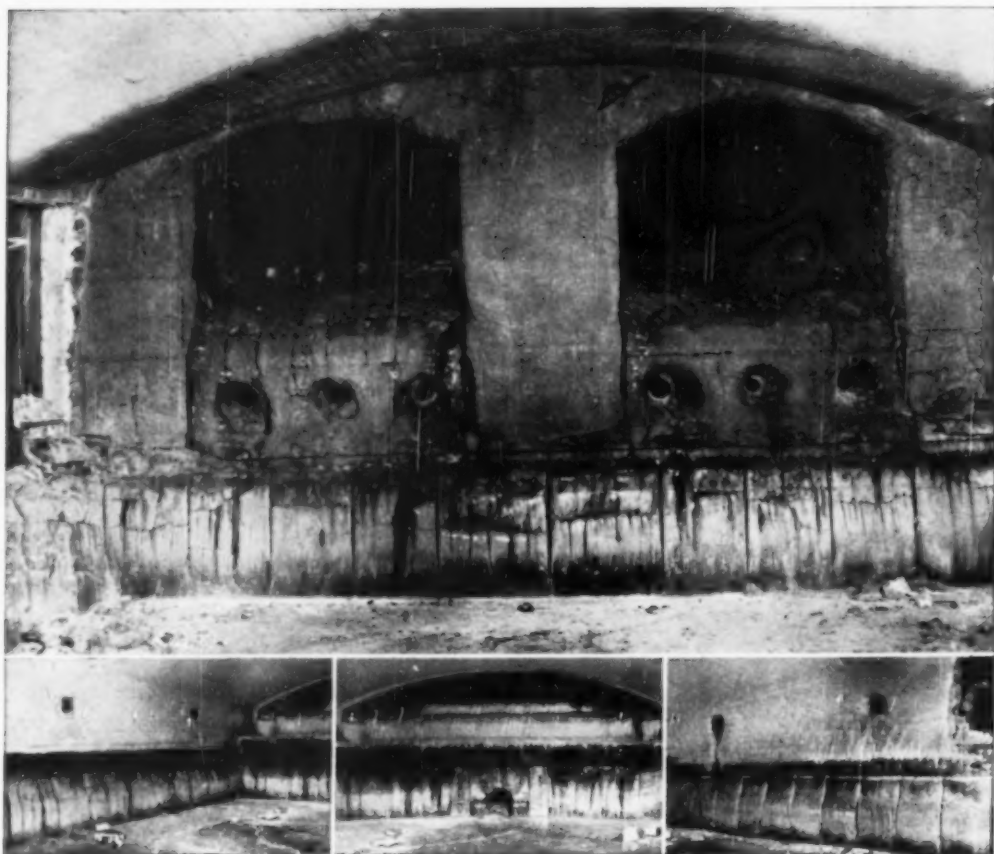
Our experience and research in the fabrication of various grades of Carbon Steel, Stainless Steels, Nickel-Clad, Stainless-Clad, Monel Clad, Cupro-Nickel, Aluminum, etc., may be of help to you. We are fully equipped, with the most modern facilities to handle complete jobs, within our limitations, in the correct alloys and methods of fabrication required to assure operating efficiency.

We also maintain a Heat Transfer Division under the direction and supervision of men thoroughly trained and experienced in this field. Our Engineering Consultation is at your service to aid you in preparation of plans and specifications for definite jobs.



**DOWNTOWN IRON WORKS
DOWNTOWN, PA.
WELDED and RIVETED PRODUCTS**

NEW YORK OFFICE: 30 CHURCH STREET



A NEW WORLD'S RECORD FOR CONTAINER TANKS?

To the best of our knowledge, the Latchford-Marble Glass Company's "C" furnace at Los Angeles has just set a new world's record for amber container-glass production. This tank was constructed with side-walls, bridgewalls and backwall of Corhart Standard Electrocast blocks. The data follows:

Square Feet of Melting Area.....	421
Total Operating Days.....	1,363
Idle Days.....	37
Total Days Life.....	1,400
Tons of Glass Melted.....	91,012
Tons Glass Per Sq. Ft. of Melting Area.....	223.3

In comment on this tank, Latchford-Marble writes: "This is an end port tank, which accounts for the bad condition of the silica shadow wall. This area

will be replaced with Corhart Electrocast Refractories on the new repair. The sidewall and bridgewall blocks as well as the backwall were found in unusually good condition. The wear was quite even all around."

Corhart Refractories Co., Incorporated,
16th and Lee Streets, Louisville 10, Kentucky

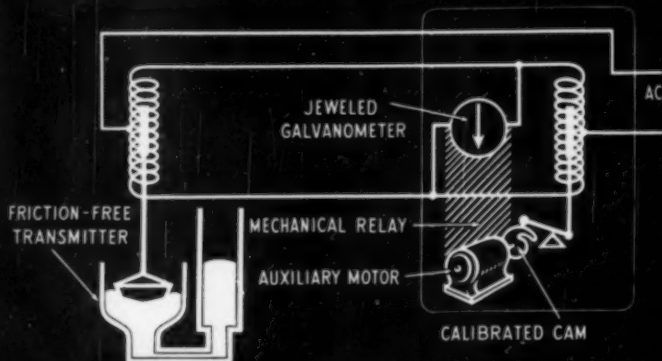
The words "CORHART," "ELECTROCAST," "ZED" and "ZAU" are Trade Marks which indicate manufacture by Corhart Refractories Company, Incorporated.



CORHART ELECTROCAST REFRACTORIES

simple....powerful....utterly reliable

HAYS-PENN FLOW METER



the
measuring
circuit
does
none
of the
operating
work



Why does the Hays-Penn Flow Meter stay accurate and last longer? Simply because the friction-free transmitter serves only as a pilot—actuates an external powerful auxiliary motor which does the work of indicating, integrating and recording.

Friction is eliminated in the manometer—the float rests on the surface of mercury in the high pressure leg, positioning the magnetic core between two reactance coils. There are no stuffing boxes, no bearings, no electric contacts, no solenoid reaction.



For full details on Hays-Penn Flow Meters, for every metering need, send for Publication 48-800.



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Complete with Tank and Drive Unit, in various types and sizes. With any style stirrers, propellers or turbine.



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1/2 to 25 H. P. Sizes
Repacked from outside



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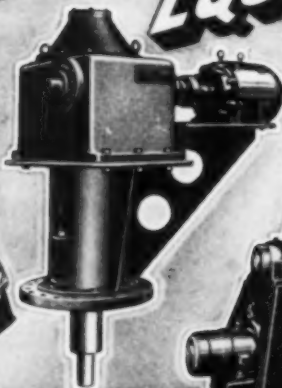


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"International" Chemical Processing EQUIPMENT



DRY BLENDERS



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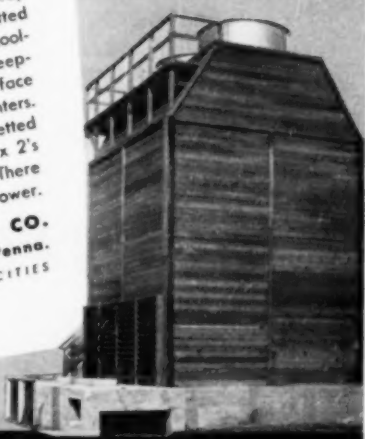
This triangle is the full scale cross section of C. H. Wheeler wood fill. The section modulus is large enough to provide maximum durability.

WETTED SURFACE Without Use of Splinters

In all water cooling towers, the cooling is accomplished by a combination of wetted surface and water drop surface. Both are important. The wood fill serves two purposes—continuously reducing the size of the water drops to increase wetted surface, and providing by its own area the necessary keeping surface. Both functions speed evaporation and hence, cooling. The correct size of wood fill does both, meanwhile keeping maintenance problems at a minimum. Wetted surface should not be attained by dividing lumber into splinters. The C. H. Wheeler Cooling Tower provides ample wetted surface, but with sufficiently rugged members (2 x 2's sawed diagonally) which last the life of the tower. There is no collapsing of the fill in a C. H. Wheeler Tower.

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REPRESENTATIVES IN MOST PRINCIPAL CITIES

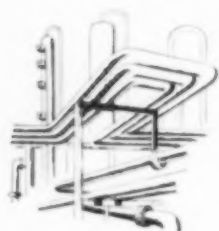
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Graver men and Graver equipment are available at strategic locations to bring the complete service to your construction project . . . whether it includes piping, masonry, equipment setting, electrical installations or erection of heavy vessels.

The facilities and experience of the Graver Construction Co. are available to you *now*. Write today for full information and quotations on your construction job.



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NEW YORK

PHILADELPHIA

CHICAGO

Shown here is one view in the spotless modern plant where Swift's Animal Protein Colloid is made. Operation is continuous, automatic... the product is "untouched by human hands," not contaminated by foreign substances.



Investigate this Modern Process Agent:

**Swift's Animal
Protein Colloid***
(made from an exclusive
Swift Process)

*Does your manufacturing process
require . . .*

1. An emulsifier?
2. A flotation agent?
3. A gel structure?
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8. An impregnating agent?
9. A base for pigment?
10. An oilproofing agent?
11. A flocculating agent?
12. A clarifying agent?
13. A filtering agent?
14. A stiffening agent?
15. A mordant?

This modern process agent, Swift's refined Animal Protein Colloid, has properties which may be employed in a wide number of processes. Even though you have used other processing agents, be sure you investigate Swift's Animal Protein Colloid now. It has unusual properties. It may meet the requirements of your present operations or help in developing new ones.

*Commercially high quality bone glue.

What is this modern process agent?

Swift's Animal Protein Colloid is made by an exclusive Swift process. Protein liquor is extracted from bones and highly concentrated. This pure liquid falls on a bed of dry finished product which adheres evenly to the droplets. Then, by continuous and automatic schedule, these droplets travel through driers and are milled and screened. This whole operation is under precise synchronized control and is completed in relatively short time.

The result is a uniform granular form that goes into solution rapidly. It's a purified product, light amber in color.

Because plant and machinery are kept spotlessly clean—the finished product does not touch material which can contaminate it with foreign substances... because of the precise control possible with Swift's exclusive process, Swift can bring you this superior processing agent. And Swift's Animal Protein Colloid has the same high quality and uniform characteristics the year 'round.

Swift's technical service yours, investigate now

Write or phone for one of Swift's special representatives. He will call and discuss Swift's Animal Protein Colloid with you. This process agent may be just what you are looking for. Write to:

Swift & Company

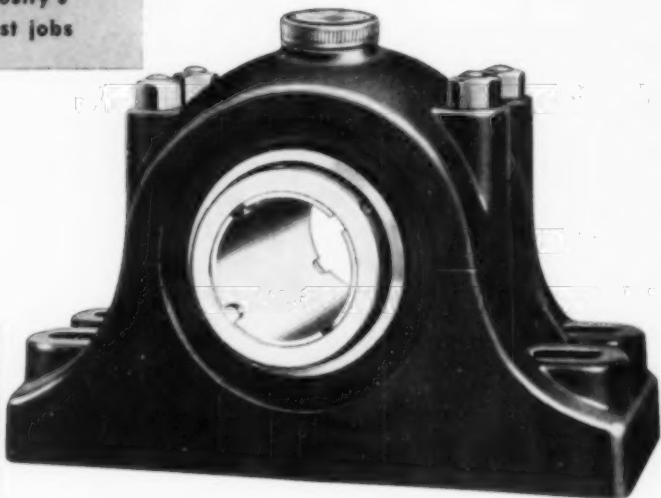
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Mounted, sealed,
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"DODGE-TIMKEN" MEANS QUALITY!

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TAPER-LOCK SHEAVES
Easy on—easy off—holds
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ROLLING GRIP CLUTCH
No toggles! Great flexibility—positive drive.



"SC" BALL BEARING
Pillow Block with new Neoprene metallic-backed seal.

It was Dodge who took the famous Timken Bearing, mounted it, sealed it, housed it and delivered a pillow block of new high quality—fully assembled, ready to lock on the shaft and carry the power loads of industry with new efficiency.

Power savings, improved machine operation, reduced maintenance, elimination of spoilage and steadier production—all result so regularly from the application of Dodge-Timken Bearings that this great line is widely accepted as the standard for comparison in up-to-date power transmission layouts.

Ask the Transmissioneer, your local Dodge Distributor, how these bearings and other Dodge "firsts" can help you achieve better, more economical production.

DODGE MANUFACTURING CORPORATION, MISHAWAKA, IND.



100-TON PULL

Three Dodge-Timken Pillow Blocks carry the load of a 100-ton pull of castings in and out of a shot blast chamber for the Falk Corporation, at Milwaukee. The bearings save the gear reducer from side pull and allow the shaft to turn easily even while taking the full load. Perfect operation for 8 years to date.

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CALL THE TRANSMISSIONEER. Look for the name of the Transmissioneer, your local Dodge distributor, under "Power Transmission Equipment" in your classified telephone directory.



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FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY,
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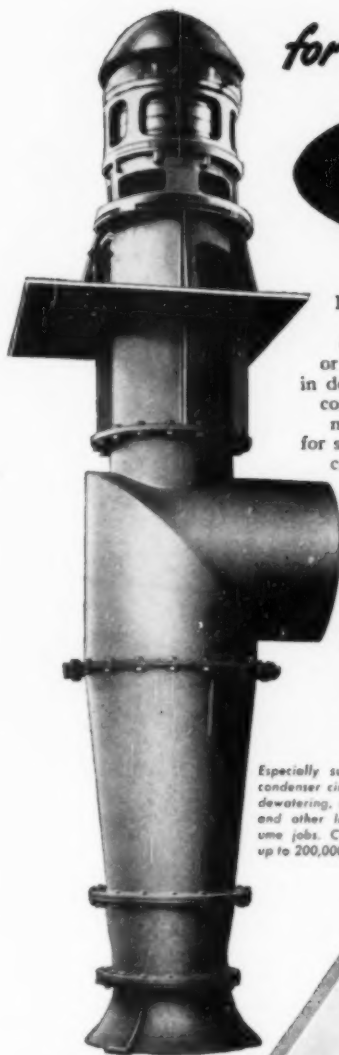
For complete details write Dept. 6 for Bulletin G-845.

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Especially suited for condenser circulation, dewatering, drainage and other large volume jobs. Capacities up to 200,000 G.P.M.



**TO KEEP
LIQUIDS
ON-THE-LEVEL**



Klipfel FLOAT VALVES

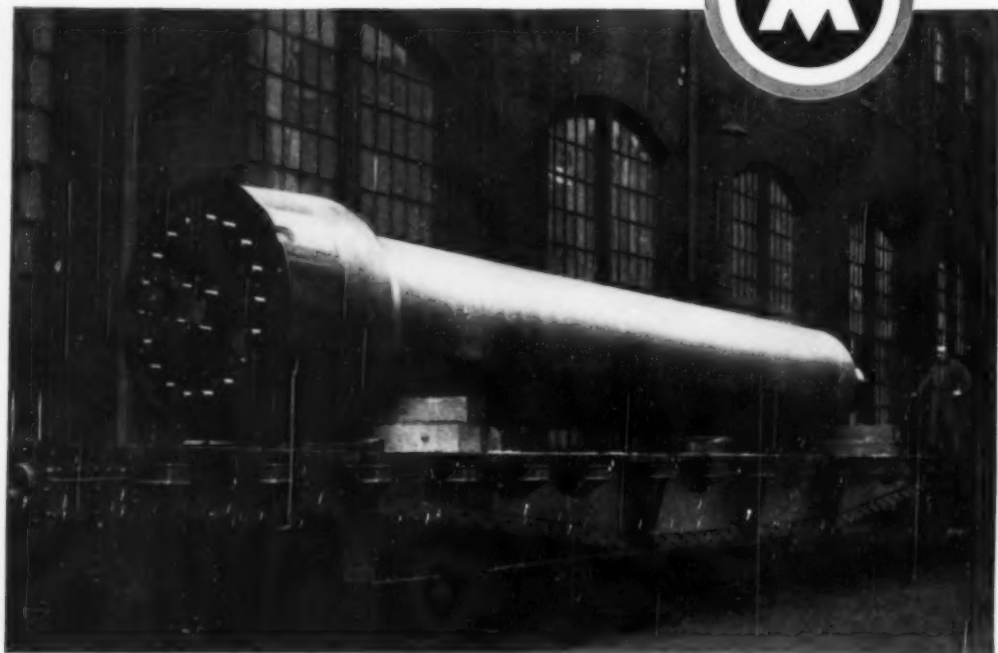
- For liquid level control that's really automatic, depend on Klipfel Float Valves. They have a forty year record of dependability on thousands of installations, large and small, water and chemical, throughout the land.
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- Also available with Klipfel's exclusive cup disc inner valve for tight control for liquids injurious to rubber and leather, and for higher pressures.

For complete details, write Dept. 6 for Bulletin 346.
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Mere size—great or small—in High Pressure Vessels is no problem at Midvale. Here, we're accustomed to take in our stride any demand for safe, dependable, easily assembled pressure vessels. And to build them to our design or your specification with **ONE PIECE, HOLLOW FORGED** bodies of carbon, alloy or stainless steel. They are, of course, machined completely and tested to prove mechanical properties. Midvale's plant and equipment are capable of turning out your vessels for immediate delivery. The Midvale Company, Nicetown, Philadelphia.

**CORROSION AND HEAT RESISTING CASTINGS
FORGINGS AND RINGS**

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CUSTOM STEEL MAKERS TO INDUSTRY

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MORE TOUGH JOBS

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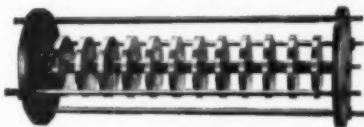
Cast stainless steel hydraulic turbine runners have to be right. The intricate shapes and thin metal sections make the job a tough one. What's more, surfaces must be clean—and the casting free from inclusions—to save machining time and costs. Add these to the corrosive elements encountered and you'll see why Chemalloy was chosen for these two jobs.

Chemalloy castings are uniformly clean... machine fast and easy with a good surface because quality is consistent—inside and out.

Where does Chemalloy get this uniformity? 1. Research, experience and skill in dealing with high alloy castings. 2. The combination of the correct corrosion resistant alloy and proper foundry technique. 3. Metallurgical control in each step of production. 4. X-ray inspection to doubly insure quality all the way through.

These runners are typical of the work being done by Electro-Alloys. They illustrate how Chemalloy is being used for the most intricate corrosion resistant castings.

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These Test Discs Solve Special Corrosion Problems. If studies of your alloy requirements do not supply sufficient information on which to base alloy recommendations, these test discs are put to work in your plant. Exposed to actual service conditions under which your castings will be used—they determine the correct alloy for your job.

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EXPERIENCE—Davison was one of the pioneers in the commercial development and production of catalysts . . . the background for today's continuing research and development.

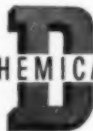
SERVICE—Davison will work with you in developing special catalysts for your particular process.

Davison has cooperated in the development, and is now producing, custom-

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Fluidized
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This De Laval blower has been designed and constructed to meet the most exacting service with the utmost reliability and efficiency. The heavy, cast casing is smoothly finished and scientifically contoured. The vanes of the built-up forged steel impeller are curved to assure stable flow characteristics. A Kingsbury type thrust bearing is employed in place of ball or collar type thrust bearings. The sleeve type bearings in the pedestal are pressure lubricated. The case rings are replaceable. The discharge opening may be positioned at any angle in 15° increments for either direction of rotation.

C-3

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TO HANDLE HOT OR COLD SULPHURIC, ALL STRENGTHS, SULPHUROUS ACID, ALUM, AMMONIUM SULPHATE, COPPER SULPHATE

● Here's a highly desirable combination of features for pumping acids economically and smoothly. "Buffalo" Lead-Acid Pumps not only have the lead protection but also the rigid, sturdy construction to stand relatively high impeller speeds and casing pressures.

These pumps also offer the high efficiencies inherent in enclosed impellers — and these efficiencies are

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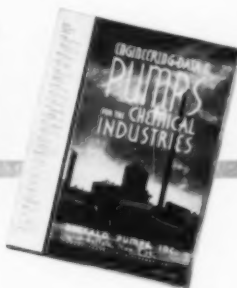
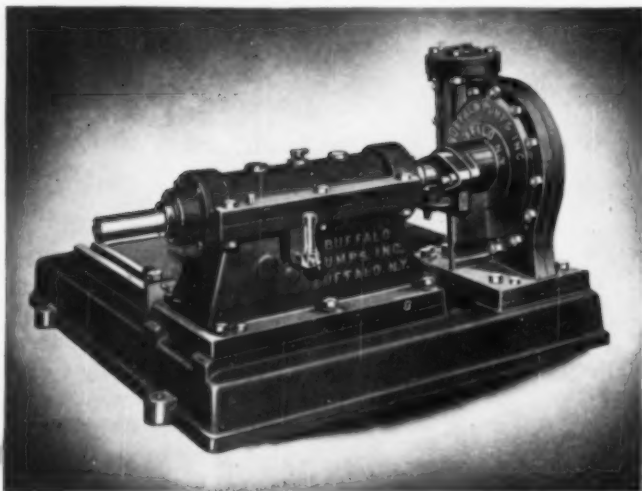
Ball bearing construction means smoother performance and longer life. Stuffing boxes are not less than 3" deep.

These pumps may be had in various special alloys, with all parts in contact with the liquid furnished in the alloy specified.

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Here's Information On Any Chemical Pump You Need!

With chemical liquids even more than other industrial liquids, the SPECIAL pump is the low-cost answer! "Buffalo" has the special pump to meet your conditions — described in Bulletin 982, below. Write for your free copy!



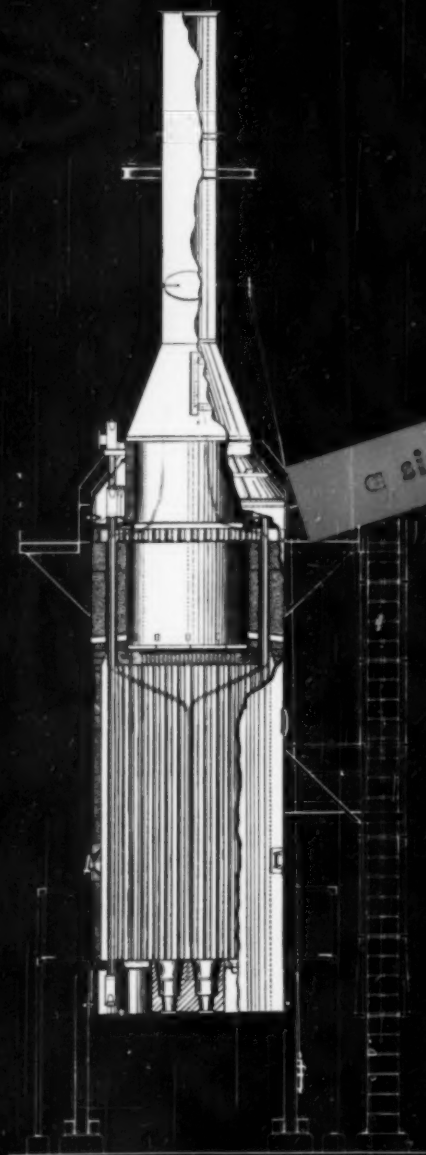
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Simple tubes, no tube replacement, and low operating costs are features. No extended tail fining was necessary in this simplified convection section design.

Write for Bulletin 9-49-7.

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a complete engineering and construction service

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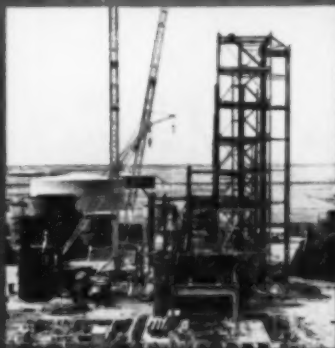
COMPLETE PETROLEUM REFINERIES
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3+8 Works Here at the Chillicothe, Ohio Mill of the Mead Corporation.



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Bulletin No. 17 will show you how easy it is to install and use Bailey electronic controls. Write for your copy today.

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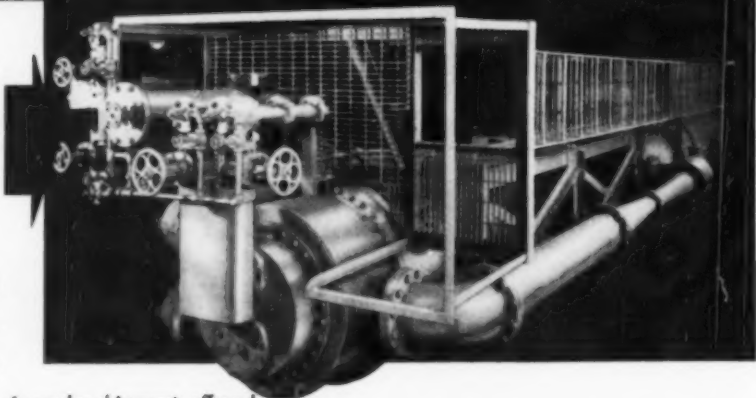
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TEMPERATURE • FLOW • PRESSURE
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*The World's
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Specializing in
CORROSION AND
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A TYPE 347
STAINLESS GAS SCRUBBER
12" I. D. x 15' overall, bottom
portion 30" diameter x 1/4" wall,
Scrubber portion 1/8" wall.
Equipped with six spray noz-
zles with sight glass opposite
each nozzle. Entire unit stress-
relieved as a unit after welding
to comply with A. S. M. E. Code.

Our staff of technical experts are pre-
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ALLOY FABRICATORS

DIVISION OF CONTINENTAL COPPER AND STEEL INDUSTRIES, INC.

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*SAVES MONEY
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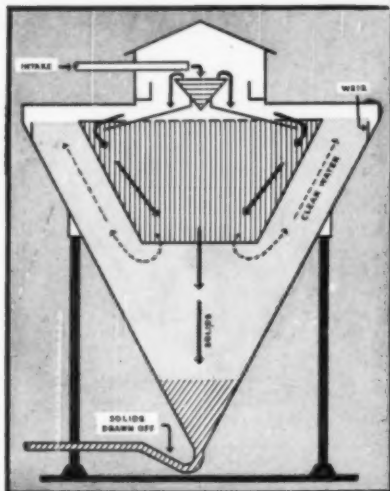
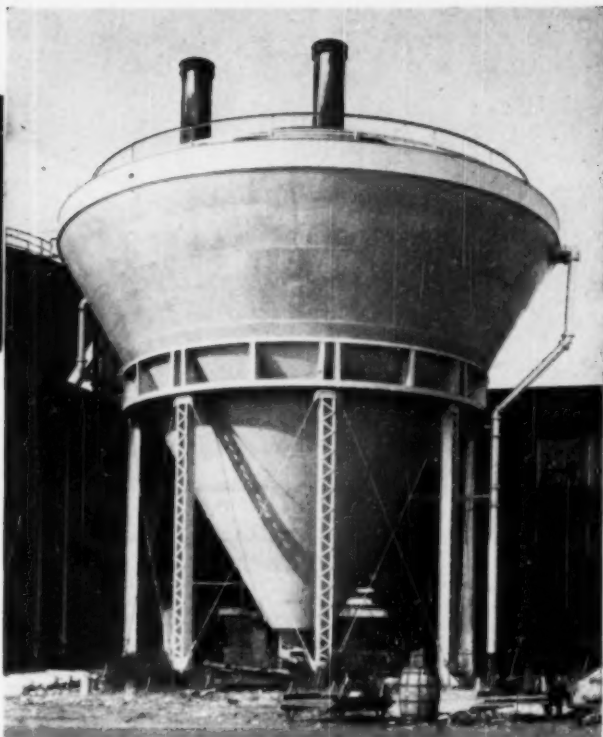
ALLEN INDUSTRIAL FILTERS, long famous in bacteriology and industry for air, gas and light liquid filtration, are now available for chemical laboratory, research and manufacturing. ALLEN INDUSTRIAL FILTERS contain Mandler Diatomaceous Filter Candles, consisting of opal or colloidal silica. True filtering is accomplished since the Mandler Candle is a porous medium and not a burned out cellular material. They have a high amount of absorption, are easily removed and cleaned, come in a complete range of sizes and densities. Write us the details of your problem and we'll be glad to send you literature and more information.



THE ALLEN INDUSTRIAL FILTER CO.
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The MARX SAVEALL

the economical way
to remove
suspended solids from
waste water



Waste white water at paper mills can now be clarified effectively and economically by means of the Marx Saveall. This ingenious unit removes most of the suspended fibrous solids (in one instance, 97.4%) and makes it possible to draw off the solids for re-use.

Clarification is accomplished by a settling process. (See diagram at left) Waste water is fed into the receiving well at the top and overflows onto the deaeration plate and over its edge into the inner cone. Suspended solids settle through to the bottom of the outer cone. Clarified water rises between the inner and outer cones and flows over the weir into a draw-off channel.

Marx Savealls are typical examples of the special steel plate structures we design, fabricate and erect. Let our engineers work with you on your next steel plate work requirements. Write our nearest office.

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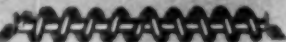


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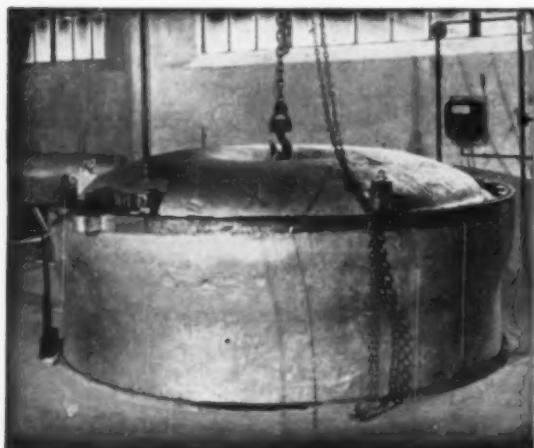
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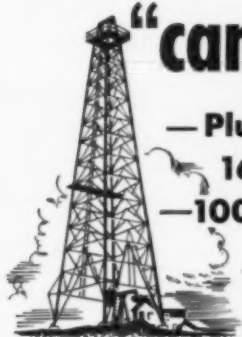


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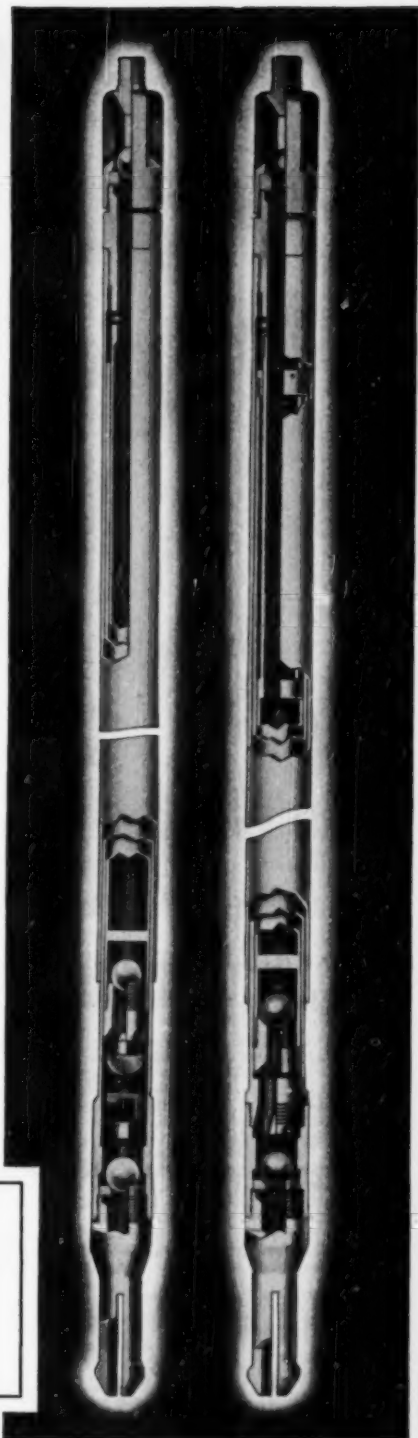
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New Eastern Facilities For Peerless Pump Division On Huge Site At Indianapolis



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OF HORIZONTAL AND VERTICAL PUMPS**

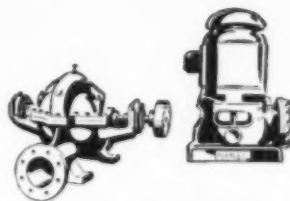
INDIANAPOLIS, IND.—Peerless Pump Division's new Indianapolis works is the former Fall Creek Ordnance Works and was acquired both for its adaptability to Peerless' long studied and applied production line for manufacture of pumps and for its strategic geographical location for quick customer service. The existing plant, based on 80 ft. x 30 ft. steel column spacing was well adapted to the setting up for high manufacture volume of pump units. Approximately 261,000 square feet of floor space (6 acres under roof) is contained in the main manufacturing building. Auxiliary buildings for production control, shower and locker facilities for 1200 employees, main offices, dispensary, etc., adds many thousands of square footage. Included in the main building are 24 capacities of 2 and 3 tons capacity capable of operating the entire range of each of the six 90 foot bays. Spur tracks enter both north and south sides of main factory building. A complete and rounded complement of the most modern machinery has been assembled to build up one of the most accurate and finest industrial machine shops.

Peerless Pump plant at Indianapolis, Indiana

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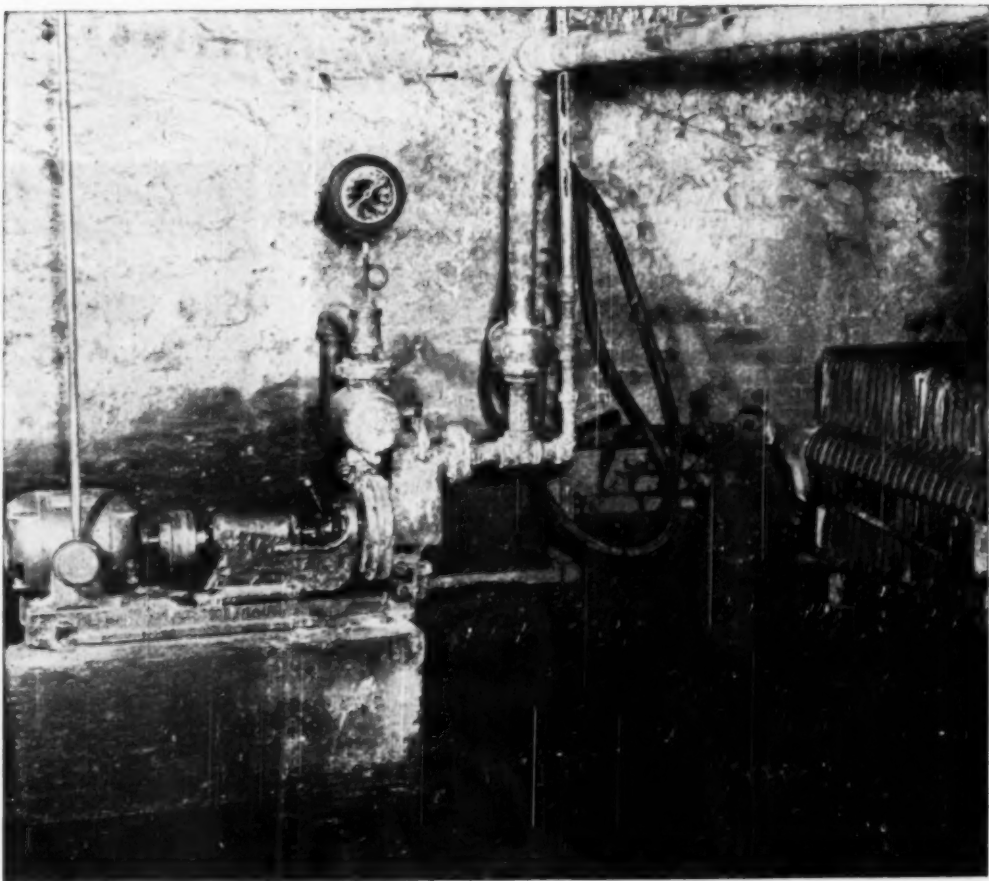
basic Peerless pump designs, to the high caliber of Peerless personnel and to Peerless extensive manufacturing facilities at Los Angeles, California, and they combine to make available as comprehensive pump service as is offered to pump owners and buyers anywhere. Peerless-Indianapolis is open for your inspection. You are cordially invited to see for yourself how Peerless-Indianapolis will exactly fit your needs for pumps and pump service. Plan with Peerless; there are horizontal and vertical types for most services, in all industries. Descriptive Bulletins are available on all types upon request.



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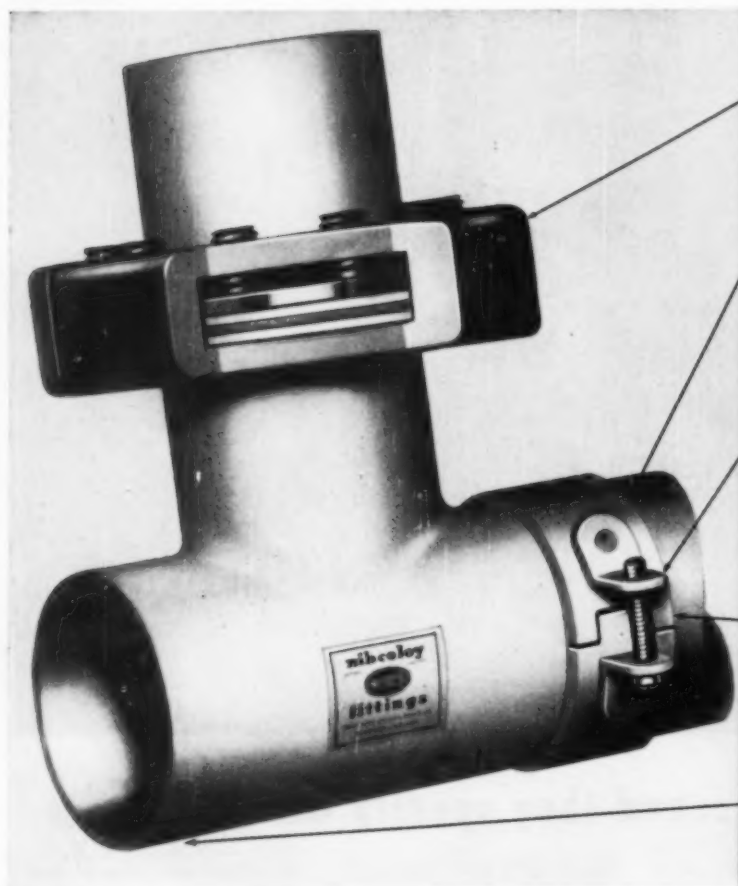
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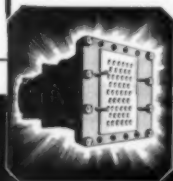
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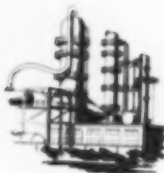
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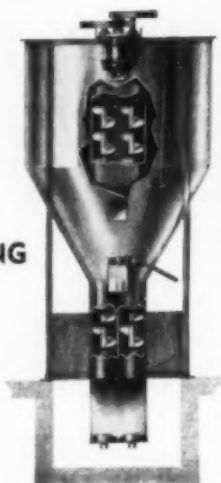
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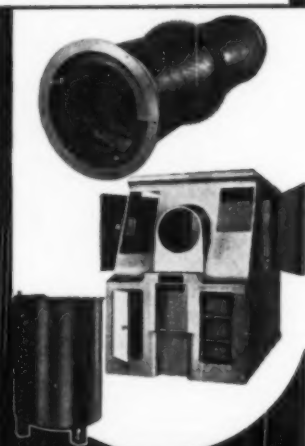
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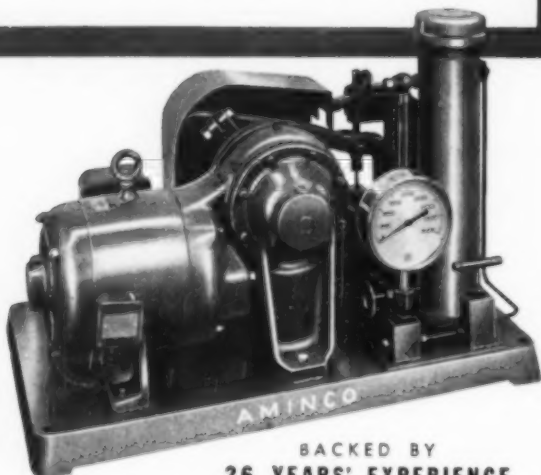
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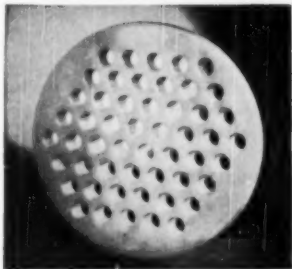
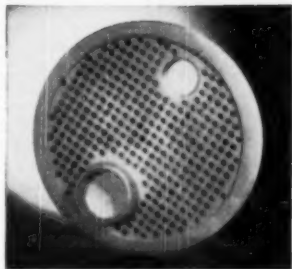
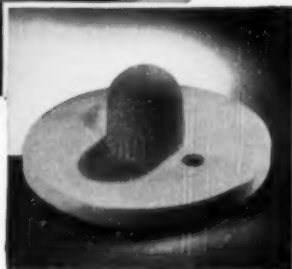
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Here is a new material of construction for plant processing equipment which may be the answer to lower costs in many phases of your plant processing cycle. Possessing all the advantages inherent in PYREX brand glass No. 7740, it can be molded into many shapes not possible by pressing, blowing, and drawing glassware. Note the examples illustrated.

Corning MULTIFORM Glass is equally as stable as PYREX. It withstands thermal and physical shock to the same degree. It is highly resistant to all acids and mild alkalis. It is non-porous. It can be obtained as an opaque white, glazed or unglazed material.

You can use Corning MULTIFORM Glass in any of the processes for which either PYREX brand laboratory ware or glass pipe is used. It safeguards product purity, extends service life, remains easy to clean, and is relatively inexpensive. It is frequently used as bubble caps in columns, as crucibles, in vacuum pumps, steam ejectors, etc. For further information write Corning.



PLANT EQUIPMENT SALES DEPARTMENT

CORNING GLASS WORKS, CORNING, N. Y.



TECHNICAL PRODUCTS DIVISION • GLASS PIPE • SIGNALWARE • LABORATORY GLASSWARE • GAUGE GLASSES • LIGHTINGWARE • OPTICAL GLASS • GLASS COMPONENTS

*** DEPARTMENT OF THE ARMY**
OHIO RIVER ORDNANCE WORKS
HENDERSON - KENTUCKY



This plant constitutes a part of the National Industrial Reserve and has been designated for disposal subject to the National Security Clause.

THIS ANHYDROUS AMMONIA PLANT
Presently Producing 6,000 Tons Per Month

Built by the Government for wartime production of anhydrous ammonia, this \$15,000,000 plant, consisting of 287 acres, 35 buildings aggregating 284,000 square feet of floor area, complete machinery and equipment, is now offered for sale.

All facilities, machinery and equipment are in excellent condition. The plant, adaptable to expansion, is currently being operated by the Solvay Process Company under contract with the Department of the Army.

Location contiguous to principal markets. Adequate transportation. Favorable for development of river-rail and terminal facilities. Low cost water supply. Ample waste disposal facilities.

Sale will be consummated through competitive bids. Sealed bids for the purchase of this facility will be received at the office of:

District Engineer
LOUISVILLE DISTRICT, OHIO RIVER DIVISION
 630 Broadway
 Louisville, Kentucky

Detailed information, arrangements for inspection and bid forms may be obtained from the Real Estate Division at the above office.

CORPS OF ENGINEERS U. S. ARMY
 WASHINGTON, D. C.

LOCATION: 13 miles southwest of Evansville, Indiana, on U. S. Highway 60 and Ohio River.

TRANSPORTATION: Illinois Central RR serves plant. 4 1/2 mi. spur track. Hard surfaced plant roads. Year around river navigation. Airport at Evansville, Ind.

UTILITIES: Power and light generated on site by 3 turbo-generators, capacity of 13,125 KVA. Stand-by power from Kentucky Utilities Co. Steam capacity 360,000 pounds per hour. Compressed air 1,030 c.f.m. Adequate fire protection.

MAJOR UNITS: Power plant; gas production plant; compression bldg.; synthesis bldg.; purification bldg.; maintenance, carpenter and machine shops; office bldg.; laboratory; barracks; cafeteria; service bldg.; stores; pump houses; warehouses. All fully equipped for use.



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Capable organization handling equipment for the Process Industries on commission basis to represent with exclusive territory well known, advertised line of process equipment. Territories available—Oklahoma, New England States and Carolinas.

RW-0067, Chemical Engineering
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WANTED SALES REPRESENTATIVES

Large, nationally known manufacturer of complete line of mixers and material handling equipment for chemical process industries requires manufacturers' agents for Boston territory, also Mid-west and South-west areas. An opportunity for alert engineering firm or other sales representatives to handle highest quality products with world-wide reputation. Write, outlining qualifications.

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Long established manufacturer of corrosion-proof linings, cements and protective coatings desires commission representative in Los Angeles, New Jersey and Birmingham, Alabama districts. Prefer man with technical qualifications, under 45.

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CHEMICAL ENGINEER with experience in construction and operation of polymerization plant for the production of Thermoplastics. Reply fully, indicating background, exp. references and salary desired. P-5991, Chemical Engineering.

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(Continued on page 380)

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PERFORMANCE . . .

GELB MACHINERY



THE GELB GIRL—JUNE, 1949

- 1—Pfaudler glass lined Still, 10 gallons, complete with condensers, receiving tank, etc.
- 1—Pfaudler aluminum jacketed reactor, 1,300 gallons. (New)
- 1—Pfaudler 250 gallon aluminum jacketed reactor. (New)
- 1—Pfaudler 500 gallon glass lined jacketed kettle.
- 1—Plate Fabricators jacketed Kettle, 900 gallons 125 psi in jacket.
- 1—Kovin 200 gallon jacketed Kettle 75 PSI, anchor type agitator
- 2—Rubber lined storage tanks, 6,000 gallons.
- 3—Rubber lined storage tanks, 3 x 6.

- 1—Bird Suspended Stainless Steel Centrifuge, 40" perforated basket with motor.
- 1—Shriver 42" x 42" Filter Press, with hydraulic closing, 46 chambers.
- 1—Shriver 36" x 36" Cast Iron Plate & Frame Filter Press, Closed delivery.
- 1—Shriver 18" x 18" Bronze Filter Press.
- 1—Sweetland #5 Filter, Stainless Steel Clad.
- 2—Sweetland #10 Filters.
- 1—Oliver Rotary Filter 8' x 12'.

- 1—5 gallon Jacketed Kettle, 60 PSI in jacket.
- 1—Cast Iron Jacketed Kettle with agitator, 600 gallons.
- 1—2,200 gallon Jacketed Kettle with agitator.
- 1—Stainless Steel Jacketed Kettle, 220 gallons.
- 1—Blow Knox Jacketed Agitated Autoclave 3' x 42".
- 2—Black & Clawson double drum Dryers, 28' x 60".
- 1—Louisville Rotary Steam Tube Dryer, 6' x 50".
- 1—Louisville Rotary Steam Tube Dryer, 54' x 30".
- 1—Rotary Steam Tube Dryer, 6' x 35".
- 2—Buffalo Double Door Vacuum Shelf Dryers, 12 and 15 shelves.
- 1—Buffalo Single Door Vacuum Shelf Dryer, 17 shelves.
- 1—Bartlett & Snow Direct Heat Dryer, Brick lined 8½' x 50'.
- 3—Buffalo Drum Dryers, 5' x 12".
- 1—Bufflovak Double Door Dryer 32" x 90" Chrome Plated Drums
- 1—Stokes Vacuum Dryer 4' x 10".
- 2—Stainless Steel Hershey Rotary Dryers, 30" x 16', 36" x 16'.
- 1—B & S Double Drum Atmospheric Dryer, 3' x 6'.
- 1—Shriver Plate & Frame Filter Press, 7' x 7".
- 1—Johnson Plate & Frame Filter Press, 36" x 36".
- 1—Sperry Skeleton 30" x 30".
- 1—Vallez Lab. Filter #2E.
- 1—Shriver 42" x 42" Filter Press Skeleton.
- 2—Sweetland Filters #12.
- 3—Vallez #28 Filters, with Glass, Aluminum, Rubber covered and copper leaves.
- 1—Sperry 18" Filter Press, closed delivery, wooden plates and frames.
- 1—Stainless Steel Storage Tank, Closed, 300 gallons.
- 5—Monel Storage Tanks, 1,800 gallons.
- 1—10,000 gallon storage tank 1" shell.
- 1—Stainless Steel Storage Tank, 4' x 5'.

- 1—Stainless Steel Storage Tank, 6,000 gallons.
- 1—Stainless Steel Vertical Storage Tank 10' dia. 20' high.
- 1—Nickel lined Jacketed Kettle, 4,000 gallons.
- 1—Pfaudler Glass lined Kettle, 220 gallons.
- 1—Struthers Wells Jacketed Kettle, 120 gallons.
- 1—Duriron Kettle, 430 gallons.
- 2—Jacketed Kettles, 1100 gallons, 5½' x 5½'.
- 1—200 gallon jacketed Kettle with agitator.
- 1—Jacketed Kettle, 300 gallons with agitator.
- 1—Abbe Buhrstone lined Pebble Mill, 6' x 12', with Motor.
- 1—Kent Pony Mixer, 30 gallons, with motor.
- 1—J. H. Day Powder Mixer, 400 lbs.
- 1—Kent Jacketed Powder Mixer, 800 lbs. capacity.
- 2—J. H. Day Powder Mixers, 800 lbs. capacity.
- 3—Ross Pony Mixers, 45 gallons.
- 1—Ross Powder Mixer, 2,000 lbs.
- 5—Simpson #0 Intensive Mixers, (New)
- 1—Abbe Silex-lined Pebble Mill #3½.
- 1—Abbe Silex-lined Pebble Mill, 8 gallons.
- 1—Paterson Porox-lined Pebble Mill, 48" x 24".
- 1—Allis Chalmers Ball Mill 5'8" O.D. x 18'; Silex lined.
- 1—Abbe Pebble Mill, 3' x 4'.
- 3—Hardinge Conical Ball Mills, 8' x 30", 5' x 24", 6' x 22".
- 1—Farrell 2-roll Rubber Mill, 16" x 36".
- 1—Thropp 2-roll Rubber Mill, 16" x 30".
- 2—Smith Iron Lined Tube Mill, 4' x 12".
- 1—Abbe Tube Mill, 4½' x 15".
- 2—Royle Extruders #1 and #2.
- 1—Ball & Jewell Rotary Cutter #½ with 5 HP Motor.
- 1—Tolhurst Center-slung rubber lined Centrifuge, 30" basket.
- 1—Tolhurst 20" rubber lined centrifuge.
- 1—Fitzpatrick Comminuting Machine, Model D.
- 2—Mikro Pulverizers #2TH and #15H.

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- 1—Devine 3'x14' stainless clad Rotary.
- 2—Bossett 3'x40', 3'x45' Rotary Dryers.
- 2—Ruggles-Coles Dryers 70"x35', 4'x30'.
- 2—Vacuum Shell Dryers with 15—30"x78" and 20—45"x42" shelves.
- 2—Buffalob 32"x60" Atmospheric Double Drum Dryers.
- 3—Louisville Steam Tube Rotary Dryers 6'x35', 6'x50'.
- 1—P&B Aprion Dryer, 48'.
- 1—Spray Dryer, Stainless Steel, 6' dia.

PULVERIZERS—MILLS

- 5—Abbe 6'x8', 5'x4' porcelain lined, jacketed Pebble Mills, motor driven.
- 1—Patterson 3'x4' steel jacketed Ball Mill.
- 5—Patterson, Abbe, Rodgers Pebble Mills, 3'x3', 3'x3', 3'x4', 4'x3', 5'x3'.
- 3—Micro Pulverizers 15H, 17H, 20H.
- 1—Porter Multiple Jar Mill, 4—1 gal. jars.
- 1—Fitzpatrick Type "D" Comminuter S.S.
- 2—Hardinge 3'x24', 6'x22" Conical Mills.
- 4—Raymond 210 and 250 Imp Mills.
- 3—Raymond 210 and 250 Screen Mills.
- 1—"Joy Bee" Hammer Mill size 2UX.
- 1—Jeffrey 24"x30" Type "A", 50 HP motor.
- 2—Tyler Hammer 3'x3', 4'x5' Screens.

LIQUIDATION

- 1—Stokes R4 Tablet Press
- 2—Stokes "R" Tablet Presses
- 3—Stokes "T" Tablet Presses
- 1—Stokes D52 Tablet Press
- 4—Badger Copper Columns 72", 30".
- 3—Buffalo Rotary Vacuum Dryers, 3' x 30'.
- 2—Tolhurst 40" Suspended Centrifugal, metal baskets and curbs.
- 1—Tolhurst 40" center slung Centrifugal, stainless steel basket and curb.
- 2—Bird Continuous Centrifuges 18" x 28" metal, 36" x 54" steel.
- 1—Baker Perkins 100 gal. stainless clad Double Arm Jacketed Mixer.

FILTERS

- 1—Sweetland 27, 27 leaves.
- 1—Sweetland 25, stainless, 30 leaves.
- 1—Sweetlands 22, 17 leaves.
- 1—Swenson 5'x4' Vacuum Rotary.
- 2—Oliver 8'x8', 8'x12' Vacuum Rotary.
- 4—Shriver 34" P&F cast iron.
- 2—Sperry 30"x30", 24"x24" wood P&F.
- 5—Sperry 30"x30", 24"x24" cast iron.
- 4—Sperry Type 36"x36" cast iron P&F.

CRYSTALLIZERS—KETTLES

- 8—28" Sections of Swenson Walker Continuous jacketed Crystallizers.
- 2—Struthers-Wells 500 and 400 gal. closed, jacketed, agitated Pressure Kettles, 1HP.
- 4—Buffalob 6' Vacuum Crystallizers.
- 6—Dopp 250, 150 gal. steam jacketed, agitated Kettles, high pressure.
- 3—Fauldler 75, 100, 150 gal. glass-lined, steam jacketed, agitated Kettles.
- 2—Fauldler 1000 and 500 gal. glass-lined, jacketed, agitated Reactors.
- 25—Stainless Steel Kettles, 50 to 500 gal.

MIXERS—SCREENS

- 1—Day 201 Ro-Ball 40"x120" stainless.
- 2—Rotex 282 Double Deck 40"x120".
- 1—Day Ro-Ball 3 Deck 20"x80" Screen.
- 1—Day Ro-Ball 4 Deck 20"x80" Screen.
- 1—Robinson Single Deck 20"x48" Screen.
- 4—Baker Perkins Stainless Lab. Double Arm Mixers, 1 and 2 gal.
- 1—Headco stainless 4 gal. Mixer.
- 2—Baker Perkins 50 gal. sigma blades.
- 1—Baker Perkins 100 gal. stainless clad, jacketed, double arm Mixer.
- 1—Baker Perkins 4 1/2 gal. jacketed, Double Arm Vacuum Mixer.
- 15—Portable Electric Agitators, 1/4 to 2 HP.
- 1—Robinson 1000-lb. rubber-lined Batch Mixer, stainless steel agitator.
- 2—1000-lb. steel, steam jacketed Mixers.
- 25—New and used Powder Mixers, 100 to 4000 pounds.

Partial List Only—Catalogs, Quotations furnished on request.

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- 5—500 gal. s.s. steam jacketed, agit. kettles.
- 10—Oliver filters up to 10' dia. by 18'.
- 1—Buffalo 32"x52" atmo. double drum dryer with extra set of drums, chromium plated.
- 1—Paterson 6' dia. by 16' Mn. lined steam jacketed ball mill.
- 3—Micro pulverizers 2 T.H., 3 T.H. and 4 T.H.
- 2—6' dia. by 50' Louisville rotary steam tube dryers.
- 1—8' dia. by 125' long, rotary kiln.
- 2—Buffalo 6' dia. jacketed vacuum crystallizing kettles.
- 1—10,000 gal. aluminum horizontal storage tank.
- Evaporators, single, double, triple and quad, effect, s.s., copper.
- 1—Solvent Recovery System consisting of 4 s.s. Absorber tanks, s.s. cond., copper rectifying column with necessary dephl. and condensers.

- 1—Unused Williams Super Titan 5 roller mill complete.
- 1—Readco 3 quart lab. mixer, 2 blades, steam jacketed, ex. proof motor.
- 2—Shriver iron 36"x36" filter press.
- 3—Day horizontal dry powder mixers 400, 800, 4,000 pound cap.
- 10—Abbe ball mixers, sizes 38"x38", 6'x5', 24"x36", 3'7" 3'7", with alloy, porcelain, rubber and Mn liner, some with steam jackets.
- 1—21 Royale extruder, oil heated with 7 1/2 H.P. motor.
- 25—250 gal. horizontal aluminum storage tank.
- 1—Thropp 8" dia. by 16" 2 roll lab. mixing mill motor driven.
- 1—Badger 36" dia. copper rectifying column complete with receivers, cond. and Deph.
- 1—Paterson 1,000 gal. nitro dissolver.

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- 4—UNUSED Bird high speed stainless steel CENTRIFUGALS, suspended type, each with 40" x 24" deep s/s basket, s/s casing and curb, each with direct connected 1800/900 RPM. 3/60/440 volts direct connected tefc motor.
- 2—UNUSED 10'6" x 16' FEINC FILTERS, wood, type 316 stainless steel and silicon bronze construction.
- 2—UNUSED 8' x 10' OLIVER PRECOAT ROTARY CONTINUOUS VACUUM FILTERS, all silicon bronze construction, each with bronze drum, valve, trough and piping.

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Kent Three Roll Roller Mill, 12" x 30" and 16" x 40".

Houchin Aiken and N.E. Soap Mills, and H-A Monel-lined Soap Plodder.

3 Rorex, Robinson #31, Schutz-O'Neill #3 Sifters, Gayco 8' Air Separator.

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Ceco Auto Carton Closing Machine.

Filler 1, 4, and 8 head S.S. Piston Fillers.

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New and used high pressure Steam Boilers 2 H.P. to 250 H.P.

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SPECIAL: 1—Patterson Pebble Mill, 36" diam. x 12", silex lined—like new.

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2—New Ribbon Type Mixers, 8 & 24 cu. ft.

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5—Steel Tanks, 67,500 gals. each.

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1—150 gal. Jacketed Glass-Lined Tank with agitator.

1—Sweetland Filter No. 5, 13 leaves.

1—Sperry Filter, 18 x 18—24 plates.

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6—New Clevon Can Filling Machines.

6—New Clevon Can Filling Machines.

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60 HP	NEW	1200 RPM	TEFC
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- 6—25,000 gal. Horiz. 10'6" x 38'8" Shell ½"
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- 1—15,000 gal. Horiz. 10'6" x 23'8" Shell ½"
- 2—12,500 gal. Horiz. 10'6" x 19'8" Shell ½"
- 2—74,000 bbl. Vert. 114' 40" High
- 50—New 10,000 gal. Horizontal

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1—42" x 24' long 400 P.S.I. Steel
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1—10' x 25' long jacketed auto-
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1—8' dia x 10' deep kettle with
agitator drive

1—6'9" dia x 8'6" deep agitator
kettle

1—6' x 6' Thropp Pebble Mill

SPECIALS

1—36" Sweetland Pressure Filter

1—"CECO" Automatic Carton
Sealer

1—"DAY" - 6BBI. Hercules
Mixer

1—"CHARLOTTE" S.S. Colloid
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KETTLES

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- 1—Turbo 248 Vert. 20 HP. 57½ RPM
- 2—Lightnin Vert. 1½ HP Exple. Fr.
- 1—Lightnin Side Ent. 10 HP
- 33—Portabla ¼ HP to 1 HP. 400, 1725 RPM
- 4 Double Arm Jkt. heavy duty: B-P 18 gal. Van. Day 35 gal. W&P 100 gal. Read 150 gal.
- 1—Day 170 gal. Horiz. Spiral. Jkt.
- 7—Floor Type lead & paste, 80 gal.

DRYERS

- 3—Double Drum Atm. 22" x 28"
- 1—Tray Dryer—1000 sq. ft.
- 2—Pan Dryers—5' x 20' 9" x 26"
- 4—Rotary, Steam Tube, 6' x 50', 6' x 53'
- 2—Rotary, Hot Air, 4'6" x 12', 6' x 23'
- 3—Rotary, Vacuum, 30' x 8', 7'6" x 20'

EVAPORATORS

- 1—Triple Effect, steel tube, 5000 sq. ft.
- 1—Single Effect, steel, 35 sq. ft. coil
- 1—Copper Van. Pm. 8' dia. x 18' H. Jkt. 88 sq. ft. coil, condenser
- 2—Copper Van. Kettles, Jkt. agit, 100 gal.

KETTLES

- 30—Stainless and Stainless Clad, 40± & 100± Jkt. open top, 25 gal. to 100 gal.
- 1—Dopp Cast Iron Jkt. & Agit, 300 gal.
- 2—Steel, Jkt. closed, 150 gal. & 350 gal.
- 2—Aluminum, Jkt. agit, closed, 100 gal. & 1000 gal.
- 1—Aluminum, closed, coils, 175 gal.
- 2—Copper, Jkt. agit, closed, 100 gal.

FILTERS

- 1—Swenson Precast Rotary Vacuum, 8' x 8' acid proof, lead & rubber
- 1—Rotary Vacuum 6' x 3', Steel
- 1—Sweetland 210, C.I. body, 33 bronze leaves, 500 sq. ft.
- 1—Sperry skeleton for 30"
- 1—Shriver P&F Wood, 20", 25 ch., open
- 3—Shriver P&F, C.I. 23", 34 ch., open
- 1—Sperry 24" C.I. 13 Rec. Pl., open dely.
- 1—Shriver P&F Wood, 12", 12 ch., cl.
- 1—Sperry P&F, Iron, 12", 10 ch., open
- 2—Bowers Frame, Lead, 20, 21
- 7—Single Plate, 8" to 36" dia.

MILLS

- 1—Allis Chalmers Cast. Ball, 8' x 7', steel liner, 250 HP motor, 2", 3", 4" balls
- 2—Abbe Pebble 20GPH, 6' dia. x 8' L
- 2—Day & Abbe Double Jar Mills
- 3—Sprout Waldren Attrition 16", 20"
- 1—Robinson Double Attrition 22"
- 2—Williams Hammer 21
- 3—Mikro Pulverizers 24, 21, Bantam
- 2—Colloid Mills, 6", Stainless

PUMPS

- 8—Duriron Cent. 90 GPM @ 45'
- 3—Stainless Cent. Sanitary Conn. Tri-Clover models 22EJ (2" x 2"), 22EEM (3" x 2") 22EJ EN (3" x 2½") NEW
- 2—Bronze Cent. Motorpumps 200 GPM—230'
- 48—Bronze Cent. from 15 GPM @ 20' to 150 GPM @ 150'—new and used
- 15—Aurora Bronze Turbine type pumps
- 1—Hydrosol Slurry, 4" x 4"
- 1—Worth, Vacuum ½ x 5, 62 CFM—27"

TANKS

- 33—Pfaudler Horiz. Sectional glass lined—total 250,000 gal.—all or part
- 1—Pfaudler Horiz. Stainless Steel, 8000 gal. water jkt, propeller agit
- 25—Stainless Steel open top tanks, some with side mixers—30 gal. to 500 gal
- 98—Steel Tanks, mammut lined, welded, horiz.—3100 gal.
- 16—Steel Tanks, mammut lined, welded, horiz.—4500 gal.
- NEW—made in our own shop
- Also large stock and listing of Aluminum, Copper, Iron, Steel, Wood, Lead lined, Rubber lined, Glass lined, Stainless, Stainless lined, etc.

STAINLESS TANKS

Fabricated to your specifications.
Write: Attn, Fabricating Div.

MISCELLANEOUS

- 2—Ing. Rand Blowers 4000 CFM @ 32"
 - 1—Sharples 216V Super Centrifuge
 - 2—DeLaval 2600 Centrifugal Separators
 - 10—Steel Tubular Exchangers, 24" x 30"
 - 8—Copper Tub. Condensers to 280 sq. ft.
 - 15—Columns—copper, steel, etc.
 - 8—Stokes Rotary 16 punch pellet presses
 - 2—Louisville Cent. Roller Press, 24" x 30"
 - 1—Davenport 3A Rot. Grains Press
 - 1—Jewell Water Still 250 GPH
- Large stock of PACKAGING EQUIPMENT
—Ask for list 2149

WRITE FOR
COMPLETE
STOCK LIST

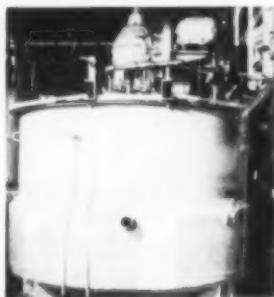


PERRY

EQUIPMENT CORP.

1513 W. THOMPSON STREET • PHILA. 21, PA.

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SPECIAL OFFER! GLASS LINED MIXING KETTLES

Pfaudler glass lined jacketed fermentation kettles with standard Pfaudler agitator and drive assembly, 1500 gallons capacity. Complete with recording thermometer.

IMMEDIATE SHIPMENT

STAINLESS STEEL MIXING KETTLES

Pfaudler stainless steel, jacketed mixing kettle, 850 gallons capacity. Shell bottom and jacket is ¼" stainless steel. Complete with air-spider agitator or standard Pfaudler drive assemblies. Constant temperature controller and accessories.

**ALL EQUIPMENT IS IN
EXCELLENT CONDITION**

FOSTER-HAMILTON, Inc.

BALDWINVILLE, N. Y.
Ph: BALDWINVILLE 11



Hardinge Ball Mills—3' x 36"—Pebble Mills 6' x 36"—8' x 48" with Motors and 4' x 16" Porcelain Lined 42" x 14" Steel Ball Mill

Mikro Pulverizers, 3 TH with 30 HP Explosion Proof Motor, Rotary Dryer and Kline 3' x 50"—5' x 40"—4½' x 30"
De-aring Auger Brick Machine—almost new
9 Chambers Dry Pan—unused.
Jaw Crushers—10 x 26—8 x 15—7 x 8
Dodge 8 and 24 cu. ft. Powd. Mixers
26 and 16 Perfection Gas Kilns
4' x 25' Louisville Dryer
2 Spencer Turbo Blowers 400 cfm—18 cu. ft. Amer. 4002
Sanvik Belt—32" x 308 ft.

PEBBLE AND BALL MILLS

Allis Chalmers 6' x 7'
2—6' x 5' alloy lined 4' x 5'
1—38" x 42" porcelain lined
1 and 4 gal. Jar Mills

Send For Stock List

LAWLER COMPANY
METUCHEN, N. J.

FOR SALE

24"x20" Buflowak Vacuum Drum Dryer.
32"x32" & 32"x22" Buflowak Double Drum Dryers.
36"x20" American Double Drum Dryer.
5"x12" Buflowak Single Drum Dryer.
100 to 300 gal. S.S. Mix Tanks, Water Jkt.
3' to 6' S.S. also Copper Vacuum Pans.
40 gal. S.S. Clad, also Alum. Kettles, Jkt.
40 & 150 gal. Copper Jacketed Kettles.
200 to 1000 gal. Homogenizers or Viscolizers.
1½ Tyler Hammer Screen, S.S.
Model C-4 "Lightnin" Mixer, ½ H.P.
Model D-4B "Lightnin" Mixer, 3 H.P.
12" Bronze Filter, 13 plates with pump.
Kron Soap, Scales, 7500 lbs. with Chain Hoists.
½ Ing. Rand Centrif. Pumps, 5 & 7½ H.P.
New 1 gal. Laboratory Autoclaves.

Send your inquiries.

LESTER KEHOE MACHINERY CORP.
1 East 42nd Street, New York 17, N. Y.
Murray Hill 3-4616

EXCEPTIONAL OFFERINGS IN CHOICE EQUIPMENT INCLUDED IN SEVERAL FMC PLANT LIQUIDATIONS

Plastics and Chemicals

- 10—Abbe and Patterson Pebble and Ball Mills from 22"x18" Porcelain Lined to 6"x18" chrome manganese inner shell; lot includes 8 multiple Jar Mills; several unlined Ball Mills are jacketed.
- 1—Gruendler Stainless Steel Ball Crusher; rolls are 30"x12".
- Insert Gas Production Unit; 4000 cu. ft. of free inert gas per hour using one gallon of gasoline per 1000 cu. ft. of inert gas.
- 1—Jumbo Extrusion Press, reciprocating type, with 12" hydraulic ram; working pressure 3000 PSI; overall dimensions 122"x33"x24".
- 1—Standard Calendar Take-Off Unit including frames, cooling rolls, slitter, winder, cooling tank and accessories.
- 1—Geddy Gray Ribbon Type Mixer, 96 cu. ft. capacity; bowl size 48"x45"x120" long.
- 3—Porter Stainless Steel Conical Blenders, 7"x18", 5"x9" and 3"x4".
- 1—Porter Steel Blender, 31"x42".
- 1—W. & P. Heavy Duty Jacketed Mixer, double sigma arms, geared both ends; bowl size 33"x40"x33", hydraulic tilt.
- 1—Heavy Duty Jacketed Mixer, 32"x40"x33", same as above, but screw tilt.
- 1—J. H. Day Moqui Jacketed Mixer; 2½ gal. cap., 12"x18" with vacuum cover, arranged for T.S.L. Pulley drive.
- 1—Lab. double arm mixer; 15 gal. 15¼"x13", fish tail blades; T. & L. Pulley.
- 1—Reed Lab. size jacketed double arm mixer, geared both ends.
- 1—Doppley Lab. Kettle, 2 gal.; 8"x7", fully jacketed with agitator and motor.
- 1—Link Belt Bucket Elevators; housing 34"x14", S.S. buckets on rubber belt, 4"x7", 14" high and 57" long.
- 5—Sections of 6" stainless steel screw conveyor, each 8' long.
- 1—Sparkler Filter Model 18-12; 24" Dia. with asbestos insulation.
- 1—Stokes Model T Tablet Machine.
- 3—Thopp 14"x20" Rubber or Plastic Mills.
- 1—Farrel Birmingham 18"x50" Plastic Mill.
- 2—Copper Jacketed Stills, 60"x79" three sectional construction with bottom section jacketed complete with agitators.
- 1—Monarch No. 1 Rotary Cutter.
- 1—Ingersoll Rand Barometric Condenser, 2,500,000 BTU/hr. good for 27" Vacuum, Size A, Serial 51214.

MISCELLANEOUS:

Power Balers, Centrifuges, Paper Cutters, Dust Collectors, Prater Mill, Weigh Hoppers, Electric Ovens, Pumps, Scales, Balances, Tensile and Moisture Testers, Pease Blue Print Machines etc.

HYDROGENATION PLANT

- 3—Hi Pressure Autoclaves 8"x21" made of 1½" steel Plate with 1½" dia. heads; jacketed and agitated with 20 H.P. motors with bevel gear reduction to 350 RPM.
 - 2—Autoclaves, 4"x5", jacketed and Agitated good for 350 PSI (250 gal.)
 - 4—Autoclaves, 24"x30" jacketed and Agitated, 350 PSI (58 gal.)
 - 6—Laboratory Autoclaves, Jacketed and Agitated; 10"x12", 10"x15", 18"x24".
- Also jacketed Kettles, Filter Presses, Drum Dryers, De Ionizers, Pumps, etc.

STAINLESS CENTRIFUGALS

- 8—American Test & Machine Co. Type 316 Stainless, Center Slung, Link Suspended with perforated baskets, size 60" dia. 20" deep, 8" lip; Curb is 66" dia. x 33½" deep; clamped cover, suitable for vacuum and pressure; stainless steel coils mounted under basket; V Belt Drive from vertical motor 15 H.P. 3/60 550V/1100 RPM with auxiliary motor 2 H.P. 3/60 550V/1160 RPM; speeds 800 RPM and 23 RPM; PRINTS AVAILABLE.
- 1—A.T.M. Stainless Steel Centrifugal; Perforate Basket 28"x14", 3¼" lip; solid curb, stainless steel 37½" x25" deep; basket has two shelves; top opening 25" with hinged cover, vapor tight; V Belt Drive from Vertical motor 3 H.P. 3/60 550V/1725 RPM.
- 1—A.T.M. Stainless Steel Centrifugal; Imperforate Basket 28"x14" 2½" lip; Suspended type basket with two shelves, hand operated plow; curb is stainless steel lined; Direct Drive by 5 H.P. 3/60/550V/1100 equipped with built in 1 H.P. motor with speed reduction and free hand clutch to drive basket at 35 RPM.
- 1—Tolhurst Stainless Steel Centrifugal; Solid Basket 32"x25" with three shelves; curb is stainless steel lined; hand operated plow discharge; basket speeds 1100 and 550 RPM.; motorized 7½ H.P. 3/60/220V/1100-550 RPM.
- 1—A.T.M. Monel Centrifuge; perforate Monel Basket 28"x16" with Solid Curb, monel clad; Liquid 3" discharge at bottom side; underdriven belt drive; basket speed 300 RPM.
- 1—Tolhurst Self Balancing Centrifugal; 40" copper perforate basket with steel curb; overhead belt drive with 7½ H.P. 3/60/220-440V/1155 RPM motor; basket speed 850 RPM.

CONTINUOUS CENTRIFUGALS

- 1—Laughlin 36"x17" Model 52; perforate basket, all contact parts of brass or bronze; Flange and silent chain drive; continuous discharge of both solids and liquids.
- 1—Bird Machine Co. 26"x72" Type LB-185, solid steel bowl; Conveyor blades of monel faced with stellite; capacity 200 cu. ft. solids per hour; feed 150 GPM max. power required 75 H.P.

CORROSION RESISTANT EVAPORATORS—CRYSTALLIZERS

Forced circulation evaporators with external "Inconel" heat exchangers and glass or rubber lined steel vapor bodies. Approx. 1270 sq. ft. heating surface; 7 ft. dia. x 23 ft. high, cone bottom vapor bodies.

Forced circulation evaporators with external "Karbate" heat exchangers and glass or rubber lined steel vapor bodies. Approx. 1100 sq. ft. heating surface; 7 ft. dia. x 23 ft. high, cone bottom vapor bodies.

Shell and tube heat exchangers having 5 ft. dia. steel shells 9 ft. long between tube sheets, 140—2" o.d. tubes per unit, 1½" Inconel tube sheets. Glass lined steel heads. With Inconel Tubes—635 sq. ft. surface. With Karbate Tubes—540 sq. ft. surface.

5500 gallon rubber lined and glass lined steel vacuum crystallizers 7 ft. dia. x 196" high in straight with 45° cone bottom.

7500 gallon Pfaunder horizontal glass lined storage tanks with No. 48T Pigment Free Enamel, 8 ft. dia. x 30 ft. long in the straight, 18" manhole center of each head.

Lot of brand new "Karbate" pipe in original crates.

Pharmaceuticals and Drugs

BRAND NEW

- 2—J. P. Devine Jacketed rotary vacuum Dryers, 4"x12" I.D., powered by Westinghouse 15 HP Explosion Proof Motors, 3/60/220-440 V. with Link Belt Speed Reduction units.
- 3—H. K. Porter heavy duty double ribbon Mixers, 370 cu. ft. capacity; 5¼"x5"x16", with 15 HP 3/60/220-440 two speed motors and Link Belt Speed Reducers.
- 3—Sperry 42" aluminum plate and frame Filter Presses, hydraulic opening and closing, 34 chambers.
- 1—Sperry 42" aluminum Filterpress, same as above, but 17 chamber.
- 4—5000 gallon stainless steel vertical Tanks with diashed heads 10"x7"9", with 18" manhole.
- 2—1600 gallon vertical steel Pressure Tanks, 66"x120", good for vacuum with diashed heads.
- 4—1800 gallon tanks, same as above BUT jacketed and insulated.
- 2—Vertical steel Tanks, 8500 gallon, interior zinc coated; 18"x15" diashed heads, 29" manhole, heavy duty pressure type.
- 2—Horizontal steel Tanks, 8500 gallon, 10"x14", diashed heads, 18" manhole.
- 1—Model A4A automatic Elec-Tri-Pak weigher with Model 38, 15" conveyor; used to fill exactly 500 grams into bottle. S.S. contact parts.
- 1—Atlas steam operated Polar Still 25 GPH, block in contact parts for double distillation.
- 1—Resina automatic Bottle Copper, LC 444 stainless contact parts, extra long intake and discharge conveyor, motorized A.C.
- 1—Productive Equip. Co. Selectro Vibrator, fully enclosed, 2"x8" with 3 HP Expl. proof motor, plain steel construction.
- 3—Colton rotary Tablet Machines, Model 9-18 RC 3. Max. tablets 2"x2½", speed 225 per min., p.d.
- 7—Lightnin' Mixers by Mixing Equip. Co., Model 330/360, 3 HP Class 2, Group 9, 3/60 440 V. AC motors with steel shafts, 11½" long, having two 15" steel props.
- 1—Lightnin' Mixer (side entering), with stuffing box; 20 HP, with Falk reduction unit, to RPM 421, chrome plated shaft, 3"x24", 3 bladed prop., 24" dia.

SPRAY DRYERS

- 1—Rogers Stainless Steel Spray Dryer 16½"x15½"x11½" complete with all accessories as successfully operated; still at present location East; former use, eggs, coffee, malt, similar products.
- 1—Instant Drying Corp. MONEL Spray Dryer 28"x20" direct oil fired; capacity evaporation 1000 lbs. water per hour; still set up where formerly used. EAST.
- 1—Controlled Spray Drying Corp. Stainless Steel Unit complete, chamber 9"x24" with 6" cone bottom; direct oil fired; 550 lbs. water evaporation per hr. 2200 CFM exit gas at 70 degrees centigrade; still installed East.
- 1—Western Precipitation Oil Fired Spray Dryer; capacity 870 lbs. per hour evaporation of water; specially suitable for inorganic chemicals; still installed N.Y. state.

FIRST MACHINERY CORP.

157 HUDSON ST.

WORTH 4-5900

NEW YORK 13, N. Y.

NEW PRESSURE GAUGES 50-75% OFF LIST

ASHCROFT GAUGES FOR HIGH PRESSURE OR HYDRAULIC OPERATION



Cat. No.	Pressure	Dial Size	Case	Conn. Size	Our Price
1055	0-2544½	4½"	Brass	½"	\$6.00
1056	0-2000½	4½"	Brass	½"	\$8.00
1014	30"-0-500½	6"	Phenol	¾" back	\$8.00
*1024B	0-200½	8½"	Iron	¾"	\$17.00
1075B	0-400½	8½"	Iron	¾"	\$17.00

LARGE STOCK OF MARSH GAUGES.

All but first listed equipped with turret-type case and Marsh recalibrator for correcting gauge error.



Cat. No.	Pressure	Dial Size	Case	Conn. Size	Our Price
*Fig. 1DP	0-100½	2½"	Steel	½"	\$1.20
Fig. 1CF	0-100½	6"	Phenol	½"	\$6.00
Fig. 1CF	0-300½	8"	Phenol	½"	\$12.00
Fig. 1CF	0-500½	8"	Phenol	½"	\$12.00
Fig. 1CF	0-600½	8"	Phenol	½"	\$12.00

HIGH QUALITY U. S. GAUGES.

100% gauge has two hands, two mechanisms and two connections. Can be used for two operations or one.



Cat. No.	Pressure	Dial Size	Case	Conn. Size	Our Price
*Fig. 520	0-100½	4½"	Phenol	½"	\$4.50
Fig. 520	0-200½	3½"	Steel	½"	\$2.40
*Fig. 622B	0-1000½	3½"	Steel	½"	\$5.00
*Fig. 520	0-1000½	6"	Iron	¾"	\$9.00

THE 1000% GAUGE shown is built for any high pressure installation where there is a severe vibration or pulsation such as compressors, oil pumps, power sprayers, etc. Gauge is equipped with gauge saver which prevents pulsation and greatly increases life of gauge. Cost of gauge saver alone is more than your cost. Price—\$5.00.



STAR BRASS GAUGES.

Alloy steel bourdon tube. Case of heavy brass with heavy screw on ring. Gauge band is equipped with micrometer adjustment.



Cat. No.	Pressure	Dial Size	Case	Conn. Size	Our Price
Super	0-100½	4½"	Brass	½" back	\$4.00
Super	0-400½	4½"	Brass	½" back	\$4.00
*Super	0-4000½	4½"	Brass	½" back	\$10.00

CLAPP GAUGES MADE TO HIGHEST SPECIFICATIONS:

Hand equipped with micrometer adjustment.



Cat. No.	Pressure	Dial Size	Case	Conn. Size	Our Price
*300	0-60½	4½"	Phenol	½"	\$4.00
Mfg.	Pressure	Dial Size	Case	Conn. Size	Our Price
Certified	0-1000½	4½"	Phenol	½" back	\$3.75

* Asterisk denotes gauge pictured.



AMTHOR DEAD WEIGHT PRESSURE GAUGE TESTER

Model 460

For testing and calibrating 0-1000½. This unit is guaranteed to be accurate within less than 1/10th of 1%. The tester is packed in the original manufacturer's wooden export crate. Complete instructions are enclosed. This unit is shipped subject to inspection and trial to all rated countries. Gauge shown not supplied with Tester.

SALES PRICE, \$175.00;

OUR PRICE, \$75.00

60 Gal. Tank Sealer Bait & Bream, color yellow. Just the thing for leaky tanks etc. Price per gallon only..... \$1.00

200 Four lb. cans of Grease Lubricating vegetable gasoline pump stuffing box. Mfg. Crane Packing Co. No. 12E. **50¢ per can**

12 Gauges... 3% discount on our unit price

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100 Gauges... 15% discount on our unit price

All gauges are unused, and are shipped subject to inspection, and if you desire trial. All gauges are of standard manufacture. Over 5000 gauges in stock. We offer the same guarantee as the manufacturer. Samples will be sent upon request.

T. & T. TOOL CO.

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ALLIED STEEL & EQUIPMENT CO.

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Offers Equipment for Your Plant

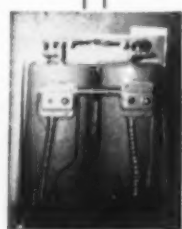
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The "KELLOGG DEHYDRATOR"

An all purpose self-reactivating dehydrating unit. To be used for removing moisture from gases. Numerous applications in the fields of Physics, Electronics and Chemistry. Dual insulated tanks with thermostatically controlled heating elements. Complete with 20 lbs. of Silica gel, heating elements, shut-off and safety valves. **\$6250**

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109—2" Walworth
1797 Lubricated Plug Cocks

9—3" Walworth
1797 Lubricated Plug Cocks

5—4" Walworth
1797 Lubricated Plug Cocks

2—6" Walworth
1797 Lubricated Plug Cocks

50—2" Wrenches
For Above 2" Cocks

Surplus material recent construction program. Will sell at 50 percent of cost. New valves weathered slightly due to outdoor storage. Other surplus materials—steel pipe, cast iron and soil pipe, etc.—Available.

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ATTRACTIVELY PRICED

AIRTEMP—75 ton Chrysler (2 NEW).
AIR CONDITIONER—20 ton Frigidaire unit.
AUTOCALVE—Vert. jacketed 6"x8", a.s. lined, 40# W.P. ASSIE.
BLENDEES—Conical, copper 2.7 cu. ft. cap.
CONVEYORS—30"x65", stainless steel belt, 24"x30", Link Belt, flat.
DRYERS—Stokes Rotary Vacuum 3'x15', Hershey Salt Dryer, monel metal lined, 72" diam. x 52'6" long.
FILTERS—Oliver, Rotary, 5'4"x6', comp. Shriver 36" Celoron Plates & Frames. Sweetland 212, 72 leaves.
MILLS—Day, 3-roll, 16"x40".
MIXERS—Blystone 48"x78" heavy duty. Champion, type E, size 2.
PUMPS—8" Centrifugal, 2500 GPM 150'. Stokes, Vacuum, model 212C, 12"x10".
TANKS—2300 gal. 5'x15'2" hor. 1/2". 4000 gal. 6'x20'3" hor. 5/16" (2 NEW). 5000 gal. 6'x24" hor. 1/2". 5000 gal. 6'x24" hor. 5/16" (NEW). 41000 gal. 12'6"x45' vert. 5/16" & 1/4".
TANKS LISTED BELOW RUBBER LINED
 33000 gal. 12'x36' hor. 7/16".
 25000 gal. 12'6"x25' vert. 3/8".
HEAT & POWER CO., INC.
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Liquidating Equipment Complete Molding Powder Plant. Send for List.

- Anderson No. 1 Expellers, Cookers & Dryers.
- Dopp 1000 gal. closed agit. Jack Kettles Duploy Acid Resist. & iron.
- Baker Perkins heavy duty Jack. Mixers. 200, 100, 50 & 9 gals.
- Lohman 4 roll W.C. 12"x36" steel Mill 20 HP.
- Mardingo Conical Ball Mills 4 1/2"x20", 3"x24", 4"x30", & 16"x40".
- Deviner Vac. Shelf Dryer 7 shelves 40"x42".
- Deviner 23 Vac. 4 shelf Dryers, econ. heated.
- Buffalo Vac. Drum Dryer, 24"x20".
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- Farrel 18"x45" & 16"x40" 2 roll motor driven mixing mills.
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- Tyler 38 Jr. Hammer Screens 24"x57" & 30"x60" solid screen. Also other sizes. Gl. Western M.D. Sifters.
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- 250 gal lead lined Kettle.
- Shriver 18"x24" wood & lead plate & frame Filter Presses.
- Sperry & Shriver 12", 18", 24", 30", 32" & 42" Iron Filter Presses.
- Reflex Sifters for Sperry 38" Filter.
- Tolhurst 40" Suspended type Centrifugals, belt-ton discharge. Also 20" to 40".
- Shraples 25A stainless steel Oil Centrifugals.
- Charles No. 6, 2 HP.
- Hobart type 25 ton Para Block Press.
- Stokes & Cotton Rotary & Single Punch Tablet Machines 1/2" to 1 1/2".
- U.S. Colloid Mill 8 inches 5 HP.
- Marco Stainless Homog.
- Dry spiral mixers 50, 100, 500, 600, 1000 & 2500 lbs. Also single & double deck sifters.
- Fast 150 gal. Jack Steel Spiral Mixer.
- Atmospheric Dryers or Ovens. Gas fired. Tray & Truck type.
- Stokes & Day Powder Filling Machines. Abbe Steroguns Sifters.
- Sance Jr. automatic vac. Bottle.
- Stainless, alum., copper, & 9 ass lined Kettles & Tanks.
- Micro Pulverizer, 1.5 to 60 HP. 3-Duriron 1 1/2" Centr. Pump.
- Pebble Mills, 5"x8", 5'x1", 30"x33" & 24"x36". Jar Mills. Lab. to 2 gal.
- Stedman & Searo-Waldron Crushers.
- Sturtevant 36" Rock Emery Mill & Robinson 210 Saw Tooth Crushers.
- 2000 & 29 Raymond Mills. Also Low & High Side Mills.
- DeLaval Multiple Chloride, 200 & 301.
- Simpson Intensive Filters 20 to 31 1/2".
- Searo-Waldron 16" D. Attrition Mill, two 7 1/2" HP. motors.
- Worthington 12"x12" 12" Vacuum Pumps.
- DeLaval Multiple Chloride, 200 & 301.
- Load & Paste Mixers up to 300 gals. Portable Elm. Mixers 1/2 to 5 HP.
- Schultz D'Neill 20" Pulverizer; also 31.
- Double Roll Crushers, 10" dia. x 14" face. Gas Battery up to 35 HP.
- Seas Machinery for Toilet, Laundry, Chip, Liquid, etc.

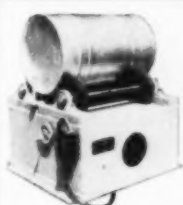
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6' x 40" Hardinge Ball Mill, with or without air separation.
 21'x1'x10' Steam Ring Roll Mill.
 8 FT. & 10 FT. Gases Air Separators.
LOCOMOTIVES
 DIESEL: 15, 30, 45 & 60 Ton & 80 Ton.
 GASOLINE: 1 Ton, 5 Ton, 8 Ton, 12, 14 & 30 Ton.
KILNS - COOLERS - DRYERS
 2-6 ft. 3 in. x 120 ft. Rotary Kilns.
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 1-6 ft. x 50 ft. Rotary Cooler.
 1-34" x 30' Rotary Dryer.
 1-70 in. x 30 Ft. Ruston Cokes XB Indirect Dryer.
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 BELTED: 315, 525, 675, 1000, 1300 & 1570 FT.
 ELECTRIC: 475, 675, 807, 1002, 1722, 2950 FT.
 DIESEL: 105, 315, 420, 603, 807, & 1000 FT.
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 5620, 7612, 8610, 9615, 9630, 10x16, 10x20, 12x24, 11x24, 13x30, 15x30, 18x30, 18x36, 22x50, 24x30, 40x40, 42x54, 42x60, 60x84.
R. C. STANNHOPE, INC.
 60 East 42nd St., New York 17, N. Y.



DRUM ROLLER

JUST WHAT YOU HAVE WAITED FOR

Adjustable from 2 to 60 gal. drums.

Equipped with 1/2 H.P. single phase motor with Reeves Drive to regulate speed, push button starter, cord & plug.

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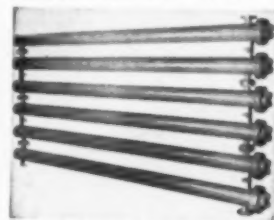
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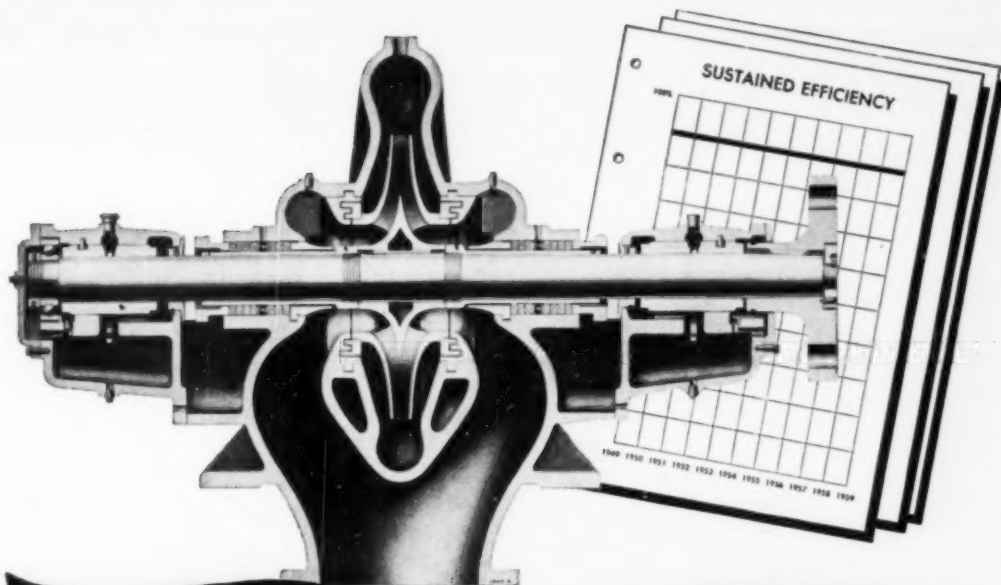
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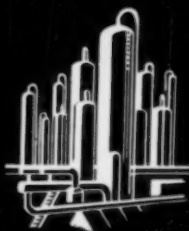
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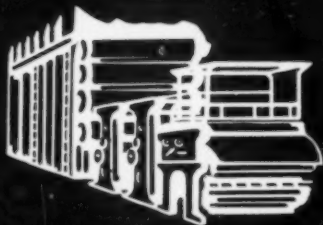
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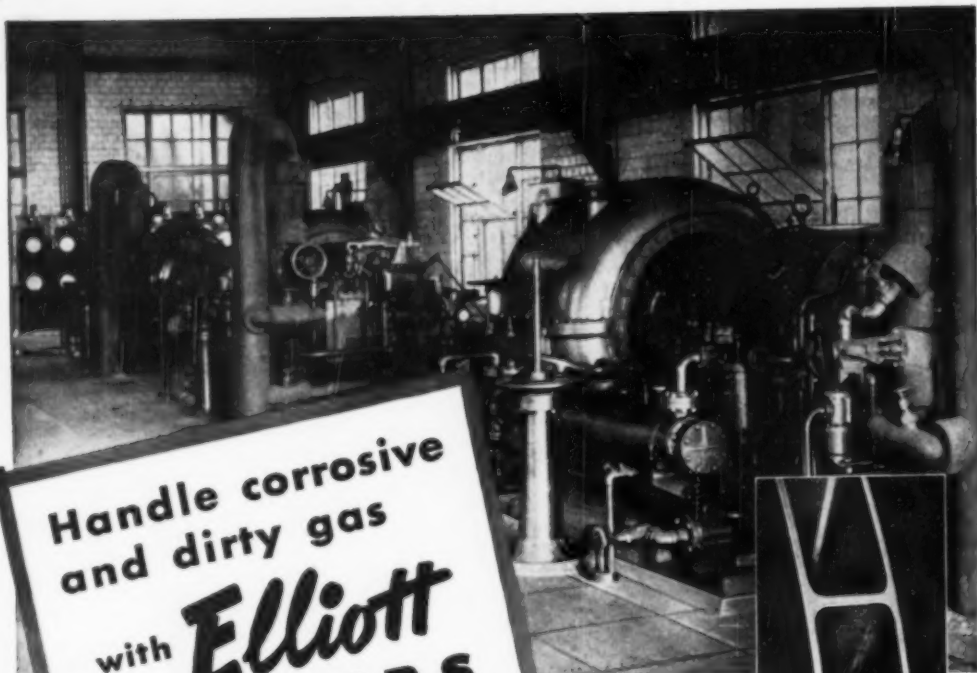
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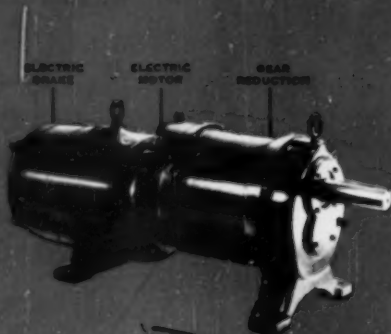
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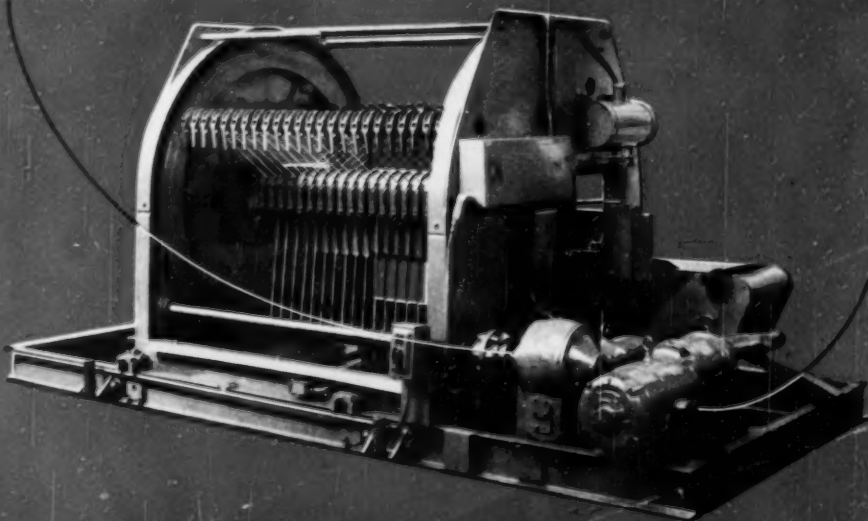
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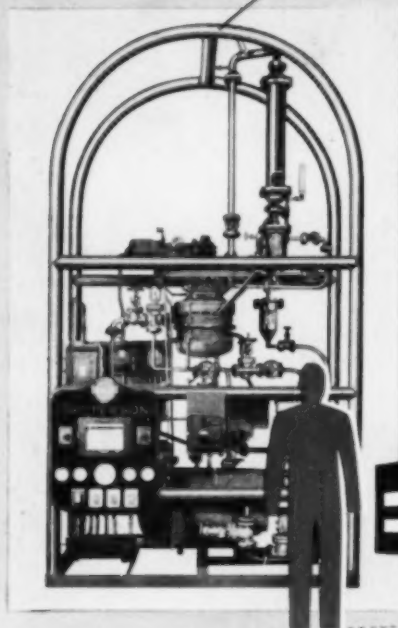
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